The TOOL ENGINEER

DECEMBER
1938

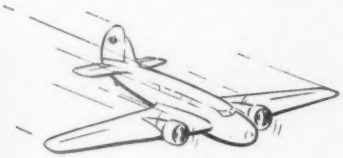
Official Publication of the
AMERICAN SOCIETY
OF TOOL ENGINEERS

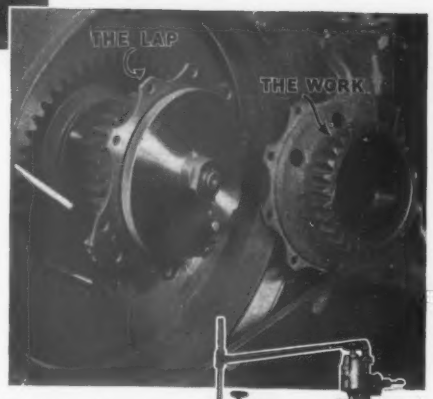
Lap Finished.....

TO FLY THE SKYWAYS

The Gears used in Aero Engines represent the highest development in Gear Design and Manufacture.

Lapping Internal Gear on Intake and Exhaust Cam Gear for Aero Engine





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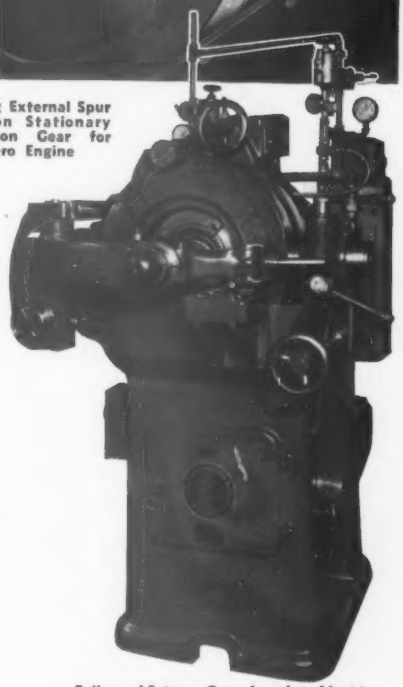

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The Tool Engineer

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Official Publication of the AMERICAN SOCIETY OF TOOL ENGINEERS

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The Tool Engineer is published approximately the first of each month. It is the official publication of the American Society of Tool Engineers, Incorporated. The membership of the Society and readers of this publication are practical manufacturing executives such as master mechanics, works managers, Tool Engineers, tool designers and others who are responsible for production in mass manufacturing plants throughout the nation and in some foreign countries.

Owing to the nature of the American Society of Tool Engineers, a technical organization, it cannot, nor can the publishers be responsible for statements appearing in this publication either as papers presented at its meetings or the discussion of such papers printed herein.

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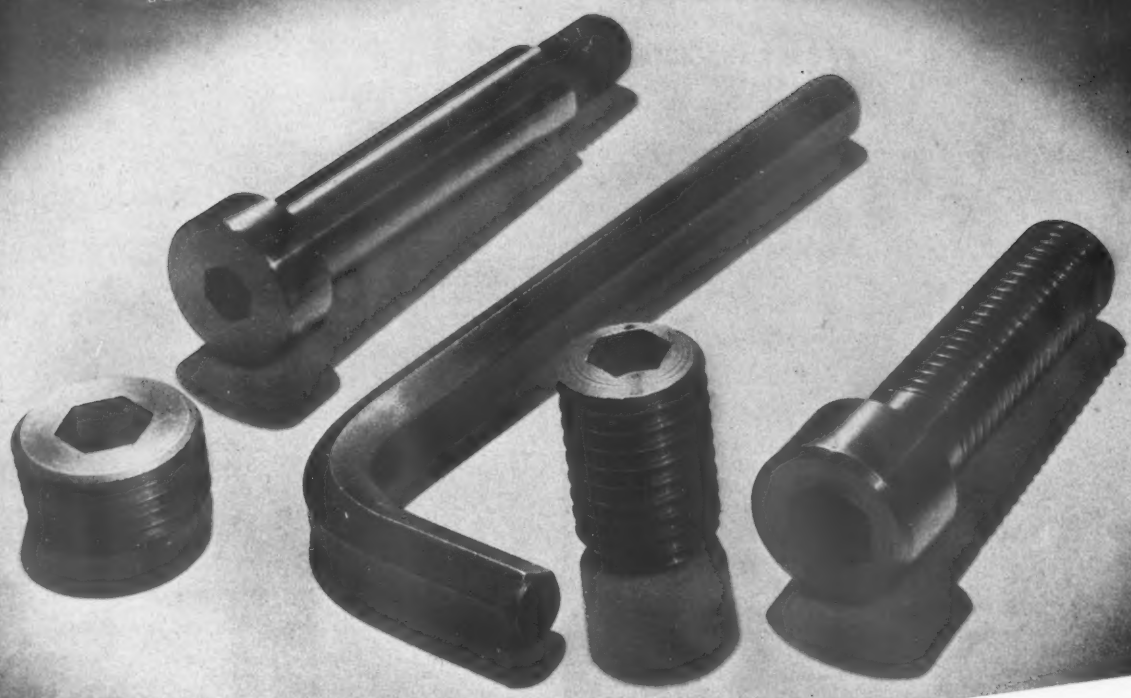

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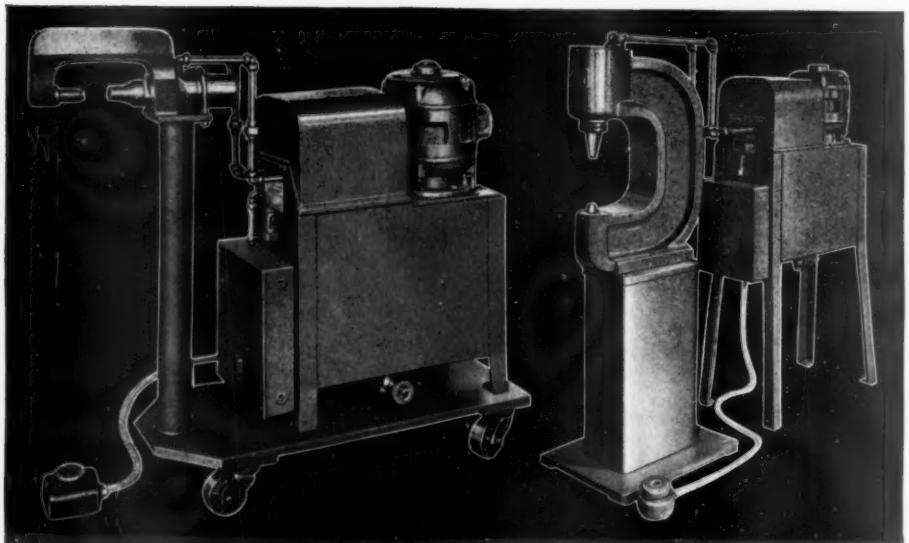

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Tool Engineers *Create* Jobs

AN EDITORIAL

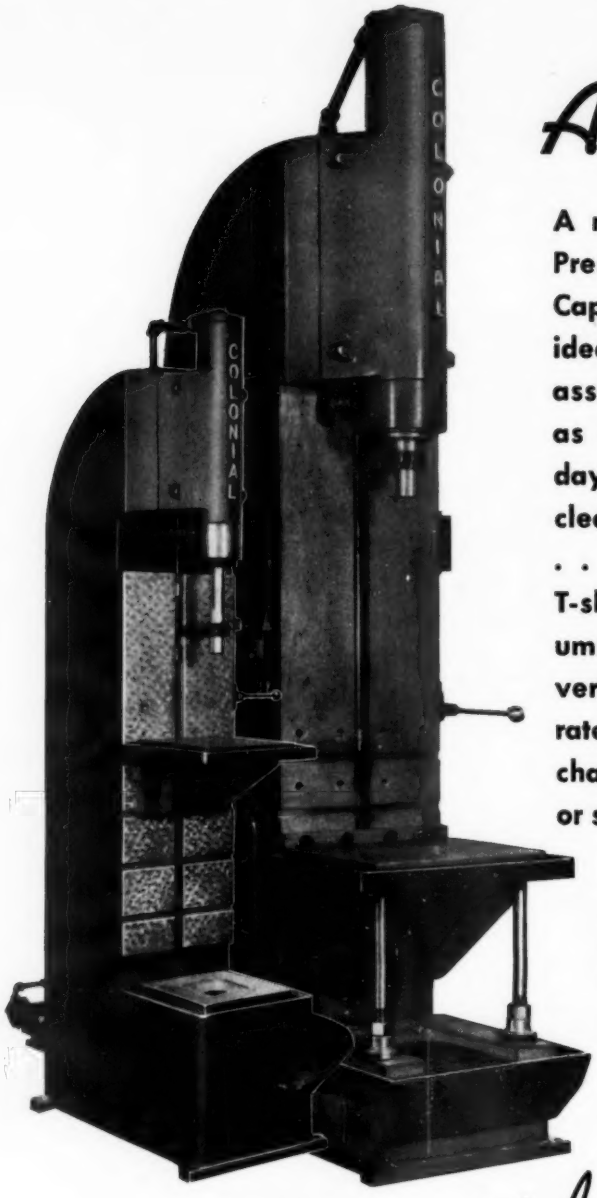
By A. E. RYLANDER

BROADLY stated, all engineers create work for the masses; capital promotes their creations, makes possible their production. It is not assumed that an inventor is necessarily an engineer, since invention springs from all walks, but in the mechanical fields, as a rule, invention is either a product of a trained engineer or what we are pleased to call engineering brains. And, if the invention goes into mass production, engineering talent inevitably enters into the scheme. The typewriter and adding machine, the telephone and radio, appliances and conveniences, automobiles and airplanes, to cite a few commodities at random, is each a creation of inventor and engineer, each has provided employment for a legion. And so on down the line, the world's army of engineers constantly creates and develops, accelerates the march of progress. Let there be a temporary halt, as a depression, and immediately engineering ingenuity asserts itself, there is invention and presto!—new industries and, with them, new fields in which to employ the idle. Engineers, then, create jobs, but without Tool Engineers their creations could not be produced in mass quantities.

Now, mass production implies a mass market; the two are quite inter-related. And a mass market means—beyond the obvious—that the factory hand can buy back, out of wages, the conveniences and necessities that he helps to produce, and in America especially, with fewer work-hours than in any other part of the world. Hence, mass production does not mean that a worker toils for the mere necessities of life—for wages only—but that, because of the low costs made possible by mass manufacture, he actually shares in its refinements, can enjoy, in comparative degree, the same luxuries afforded by his employer. For example, the midget radio and the console bring about the same programs, the low priced automobile and the town car are both transportation, the cottage and the mansion are both homes. And today, beauty and quality are built into all price ranges.

This slant on mass production is presented because the average person does not see its finer aspects, its effect on modern civilization. True, the Machine Age has created new and trying social problems (what age hasn't?) and with the machinery of construction have been evolved ingenious engines of destruction. But in peaceful fields, such as we prefer to tread, the Machine has lifted a tremendous load from the shoulders of man. Compare, for example, the arduous construction of the Pyramids with the erection of a modern skyscraper, where a crane operator lifts many tons with the flick of a wrist. Or compare the shop of but a generation ago with the modern plant, with its safety, its conveniences, its saving of man power. We progress, make no mistake about that.

Without Tool Engineers there would be no mass production, since mass manufacture is not possible without tools. "But," say the anti-technologists, "modern tools and automatic machinery create unemployment, they replace labor." Oh sure!—let us concede a half truth. All tools—all automatic equipment—are designed to replace labor or to speed up production. But every tool, every automatic appliance, has to be made, their making employs skilled labor. And as new tools are created new factories are built, employing more skilled workers, let alone technical staffs and office help, salesmen and the indirect employment afforded of advertising and merchandising. Besides, the lower costs effected promote sales for the concerns buying the tools; we come right back to the starting point, not of a circle but of an ever widening coil going on to infinity. Thus, in the design and creation of tools, the Tool Engineers not only hold to all engineering traditions in that they promote progress of themselves, but for all engineers whose creations depend on tools for production. And that, in the final analysis, means work for the many, for the masses. Directly and indirectly, Tool Engineers create jobs.



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A.S.T.E. Announces Huge Fact-Finding Program

Committee Headed by Prof. John Younger to Gather Facts and Data on Men and Machines

THE biggest task any engineering organization has ever set for itself—a nationwide fact-finding program to determine the effect the MACHINE has had and is having on EMPLOYMENT and our STANDARD OF LIVING—has been launched by the American Society of Tool Engineers.

Every resource of the Society—with its thousands of members—together with the cooperation of universities, economists, national research boards, publications, etc.—is to be organized into a gigantic research bureau to get at the real facts.

In announcing the program, Walter F. Wagner, A.S.T.E. President, said:

"There is probably no question as vital to Society in general today, as the problem of what effect the machine is having on employment or unemployment—on raising or lowering the standard of living and income of the nation as a whole.

"Not a day goes by but that claims and counter-claims are propounded publicly to the effect on the one hand, that the machine is creating unemployment—and on the other, that the machine is responsible for increased employment and higher standards of living. If the argument ended there, perhaps, the question might well be disregarded as being mainly of theoretical importance. But day by day the question is coming more and more into the foreground. It is entering gradually into every consideration affecting the future of our society—on the farm, in industry, and in the home.

"The entire question is too vital to the future well-being of our nation and society to continue to be primarily a subject of debate. The American Society of Tool Engineers believes that only a complete knowledge of all contributing FACTS—properly analyzed and interpreted—can furnish the real answer.

"We realize that the gathering of all the facts necessary to permit making a complete study, is a monumental task. Nevertheless, the job necessary to get the real story or stories has to be tackled by someone sooner or later.

"The A.S.T.E., being a technical organization devoted to the cooperative solution of production problems is the logical organization to sponsor such an activity. The answer to the question is of vital importance to every A.S.T.E. member.

WALTER F. WAGNER
President, American Society of Tool Engineers

"Furthermore, we feel that the A.S.T.E. is ideally set up to initiate and correlate such a program. With thousands of members in the manufacturing end of the nation's mass production industries, we have a nucleus of manpower for such a research program second to none in the country.

"While individual members of our Society may have and do have definite opinions on the subject, based on their personal experience, the A.S.T.E. itself—as a technical organization—has no opinion. Its program is conceived on the premise that the real facts—whatever they may tend to prove or disprove—will be welcomed by everybody.

"Our first step in carrying out this program is the setting up of committee structures to tackle the question from different angles. We are very happy in having secured the assistance of John M. Younger, Professor of Industrial Engineering, Ohio State University, and first honorary member of the A.S.T.E., to function as General Chairman of the Fact-finding committee structure. In his capacity, Professor Younger is in a position to organize and supervise the work of the various committees to be set up, toward the end of providing an unbiased analysis of the true facts.

"Operations of some of the many sub-committees are already getting under way. At least one of these, our bibliography committee, is scheduled to present its first report on March 13th, the day prior to the opening of the Machine and Tool Progress Exhibition in Detroit.

"The function of this committee is to compile a complete history of all published factual information pertaining to the subject that has already appeared in print. This information will not only be extremely valuable in itself but will be useful also as a guide in the directing of research activities—avoiding duplication, where possible—and enabling the following of new angles of approach if indicated as desirable.

Professor Younger,* in accepting the appointment as General Chairman, said:

"I am indeed happy to play a part in the efforts of the American Society of Tool Engineers to determine the relationship between the machine and employment and standard of living. There is no subject more vital confronting society and industry. The task of digging out and correlating the real facts is a big one, of course, and beyond the scope of any one man or small group of men to accomplish.

"In addition to the membership of the A.S.T.E. we are hopeful of obtaining the active cooperation of numerous independent bodies—industrial, governmental, and labor—in the carrying out of this fact-finding program.

"In general the attack on the problem will be three-fold, depending on the starting point; development of industry; development of the machine; and developments pertaining to labor. Base-lines to furnish an adequate means of comparison will have to be established, since the machine—for all we think of it as development of our generation—is as old, fundamentally, as the first mechanism which replaced physical effort of any kind.

"As fast as certain phases of the study are completed, the information will be made available to all interested parties—governmental, industrial, and labor."

* Professor Younger is head of Industrial Engineering, Ohio State University, Columbus.

The Development of *High Speed Steels*

By
L. C. GORHAM
PRESIDENT GORHAM TOOL COMPANY
A Paper Presented Before
Detroit Chapter A.S.T.E.

THE history of High Speed Steel began with a discovery by Robert Mushet in England about 1868. Mushet steel was not, however, a high speed steel in the sense which we now accept. The terms used in describing it were "self-hardening" and "air-hardening." It remained as the only tool steel, other than plain carbon steel, for a period of about twenty-five years.

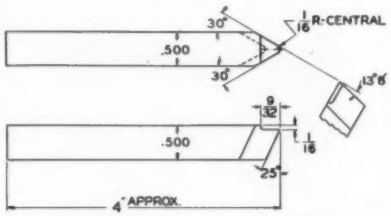
In the year 1895 the steel trade began to realize the significance of the high tungsten content in Mushet steel. Concurrently, it was recognized that Molybdenum was equally capable of establishing the characteristic of self-hardening, and even at this early date, it was observed in a general way that the percentage of Molybdenum required to produce self-hardening was less than the percentage of tungsten. At this stage in the development of materials for cutting tools, Tungsten did not hold any particular advantage over Molybdenum, and, as a matter of fact, based on production figures for increasing the years 1900 to 1904, it appeared that Molybdenum might win the race for supremacy as the major alloying element in the high speed field.

Early in the 20th century, Taylor and White made an important disclosure concerning the heat treatment for steels to be used in high speed applications. Actually, the result of their work dictated the heat treatment which we use for high speed steel today.

Entering the period of great activity which followed their disclosure, Molybdenum, as the principle alloying element in high speed steel, rapidly lost ground. During the next twenty-five years, little or no high speed steel, in which Molybdenum was the principal element, was produced. Conservatively stated, over 85 per cent of all High Speed Steel used in this country during this period was of the same general type, usually designated as the 18-4-1 type, that is, containing about 18.00 per cent tungsten, 4.00 per cent chromium and 1.00 per cent vanadium.

From 1900 to 1914, the production steels in use were of an entirely different type than those developed and increasingly used thereafter. The standardization work on production steels was begun during this period by the Association of Licensed Automobile Manufacturers. In 1910 the work was taken over by the S.A.E. (Society of Automotive Engineers), and has been continued by them, a big undertaking that has proven of inestimable value to all industry.

Now we begin to encounter production steels alloyed with nickel, nickel-chromium, molybdenum, chromium-vanadium, tungsten and silico-manganese regularly specified by S.A.E.



standards. Heat treatments have been developed to produce maximum physical properties in tensile strength, hardness, etc. The use of these production steels has been reliably estimated to have produced a saving of at least 15 percent in the total annual retail value of American automotive products.

With the advent of the S.A.E. production steels came an insistent demand for better high speed metal cutting tools. Starting about 1910, we find manufacturers specializing in metal cutting tools coming into the picture.

Production in the automotive fields was increasing by leaps and bounds, and, while most of the metal cutting tools had been previously furnished by established eastern manufacturers, these suppliers were slow in anticipating the requirements of this rapidly growing industry. Consequently, several mid-western companies began the manufacture of metal cutting tools, such as hobs, milling cutters, drills and reamers. In close contact with this great activity, they were able to make quick delivery of not only standard tools but to help design and make the many special tools that were required.

Up to this time, and for an extended period following, the heat treatment of high speed steel was considered a more or less secret art to be closely guarded and handed down from father to son. This was largely due to inadequate equipment and the necessity of depending upon the human factor. Fortunately, science has relieved us of this nightmare; it is now possible to assemble heat treating equipment with positive furnace temperature and atmospheric control.

In the meantime, many different brands and types of high speed steels have become available other than the 18-4-1 type. No attempt has been made to identify the different brands in relation to analysis, as has been done with the production steels.

Questions naturally arise as to the reasons for so many different types. Starting with the 18-4-1 type which has stood the test admirably for so long a period of time, we must give it full credit and use it as a basis of comparison. In this steel the tungsten content of approximately 18.00 percent is the result of years of experience, and apparently this percentage combines the best advantages of wearing properties, cutting ability and toughness. The 4.00 percent chromium seems to give the best balance. While decreasing the 4.00 percent increases the toughness, it appears to decrease the hardening ability, and a greater percentage than 4.00 per cent tends to cause brittleness.

The element vanadium adds increased cutting efficiency to high speed steels, the exact reason for which does not appear to be wholly explainable.

The carbon content of all types of high speed steels is of great importance, since with the tungsten and chromium remaining constant, the hardness and toughness of the steels will vary with the carbon content. For tools such as milling cutters, drills, reamers, etc., a carbon range of from 0.67 to 0.73 percent gives the best combination of hardness, cutting ability and toughness.

The manganese content, while not mentioned in the different types of high speed steels, is quite important since it makes the steel more sensitive to grain growth at high quenching temperatures. As a high content is likely to cause excessive breakage in heat treating, the manganese is usually held to under 0.35 percent.

The silicon content in high speed steels is not of particular importance as long as it is held within reasonable limits, usually under 0.35 percent.

In order for users to receive the fullest advantage of the years of effort to strike an alloy balance, it was necessary for producers to recommend an approximate heat treatment, both as to quenching temperature and drawing temperature. Regardless of how carefully the steel had been alloyed, forged, rolled and annealed at the mills, how much time and labor expended in engineering and fabricating the tools, the ultimate result depended upon the proper heat treatment to attain the highest possible cutting efficiency. The highest cutting efficiency does not mean the highest hardness, but a proper combination of hardness and toughness which varies greatly when cutting different materials. For cutting non-ferrous metals, extreme hardness is desirable. For cutting hard alloy steels, especially intermittent cuts, toughness is the desired factor, and can only be attained by sacrificing hardness.

Hardness and toughness are diametrically opposite qualities. Both are desirable in an efficient cutting tool, and it is necessary for tool manufacturers to know the application as to the mate-

(Continued on page 13)

TABLE 1—COMPOSITION CHART

H.S.S. No.	Mo %	W %	Cr %	V %	Co %	Cu %	B %	C Range %	Base Price
1		18	4	1				.70-.75	$ .67
2		18	4	2				.75-.85	.77
3		18	4	1	4			.70-.75	1.10
4		18	4	2	8			.75-.85	1.34
5		22	5	1.5	12			.85-.90	2.42
6	8	1.5	4	1				.75-.80	.54
7	8		4	2				.80-.85	.54
8	9		4	1.5	2		Added	.70-.75	
9	8	1.5	4	1	4			.75-.80	.63
10	8		4	1.5	8		Added	.70-.75	.85
11	6	6	4	1.75		2.5		.75-.80	

TABLE 2—HEAT TREATMENT & HARDNESS CHART

H.S.S. No.	Quenching Temp. °F	Drawing Temp. °F	Rockwell "C" As Quenched	Rockwell "C" As Drawn
1	2375	1050	65.0-65.5	65.5-66.0
2	2375	1050	66.0	65.0
3	2375	1050	64.5-65.0	66.5
4	2400	1050	64.5	64.5
5	2425	1050	62.5-63.0	64.0-64.5
6	2225	1050	64.0	64.0-64.5
7	2250	1050	64.0-65.0	64.0-64.5
8	2150	1050	64.0-65.0	64.0-64.5
9	2275	1050	64.0-64.5	66.0
10	2175	1050	66.0	65.0
11	2325	1050	61.0	65.5

RUN NO. 1—CHART OF BREAKDOWN TEST ON S.A.E. 4340 IN SURFACE FT. PER MINUTE

H.S.S. No.	Tool No. 1	Tool No. 2	Tool No. 3	Tool No. 4	Tool No. 5	Tool No. 6	Ave.
1	223	226	217	214	220	223	220
2	248	240	236	240	240	236	240
3	231	231	236	236	228	236	233
4	240	248	236	240	236	231	238
5	253	259	262	256	253	245	255
6	231	234	240	242	242	242	238.5
7	226	231	223	223	223	226	225
8	236	228	228	236	236	226	232
9	231	240	228	236	236	231	234
10	248	236	242	248	240	242	243

Spindle Speed 168 R.P.M. Depth of Cut .050" Feed Per Rev. .015" Size of Tools .5"x.5"x4"

RUN NO 2—CHART OF BREAKDOWN TEST ON S.A.E. 4340 IN SURFACE FT. PER MINUTE

H.S.S. No.	Tool No. 1	Tool No. 2	Tool No. 3	Tool No. 4	Tool No. 5	Tool No. 6	Ave.
1	226	226	220	226	214	217	221.5
2	245	245	234	245	240	236	241
3	236	245	236	248	240	236	240
4	256	234	240	253	242	240	244
5							
6	240	226	234	234	234	220	231
7							
8	245	236	234	240	234	240	238
9	245	250	236	236	231	236	239
10	242	253	240	240	236	240	242
11	242	242	240	240	245	240	241.5

Spindle Speed 168 R.P.M. Depth of Cut .050" Feed Per Rev. .015" Size of Tools .5"x.5"x4"

RUN NO. 3—CHART OF BREAKDOWN TEST ON S.A.E. 4340 IN SURFACE FT. PER MINUTE

H.S.S. No.	Tool No. 1	Tool No. 2	Tool No. 3	Tool No. 4	Tool No. 5	Tool No. 6	Ave.
1							
2							
3							
4	250	240	260	242	240		246
5	245	245	240	256	248	253	248
6	250	231	228	223	242	228	234
7							
8							
9	242	236	245	240	226	236	237.5
10	250	231	214	240	240	240	236
11	242	231	242	231	234	223	234

Spindle Speed 168 R.P.M. Depth of Cut .050" Feed Per Rev. .015" Size of Tools .5"x.5"x4"

TABLE 3—CHART OF BREAKDOWN TEST ON S.A.E. 4340 IN SURFACE FT. PER MINUTE
AVERAGE OF THREE RUNS

H.S.S. No.	Ave. Run 1	Ave. Run 2	Ave. Run 3	Ave.	No. of Tools Tested
1	220	221.5		220.7	12
2	240	241		240.5	12
3	233	240		236.5	12
4	238	244	246	242.6	18
5	255		248	251.5	12
6	238.5	231	234	234.5	18
7	225			225	6
8	232	238		235	12
9	234	239	237.5	236.8	18
10	243	242	236	240.3	18
11		241.5	234	237.7	12

Spindle Speed 168 R.P.M. Depth of Cut .050" Feed Per Rev. .015" Size of Tools .5"x.5"x4"

(Continued from page 10)

rial to be machined to be able to attain the proper balance between hardness and toughness to provide an efficient cutting tool. One hears complaints that tools are too soft, when a careful analysis of the trouble shows that the opposite is true, that the tools are too hard. Excessive hardness for the particular application results in a crumbling of the cutting edge, then excessive abrasion creates sufficient heat in the tool to make it burn and break down, giving the appearance of the tool being too soft. This is corrected in many instances by redrawing the tool at higher temperatures which will reduce the Rockwell hardness and provide sufficient toughness to support the cutting edge and effect a very satisfactory performance. Many times a particular type of high speed steel has been condemned for certain applications when more careful attention to this balance between hardness and toughness in the heat treatment of the steel would have provided a highly efficient cutting tool. Probably our failure to thoroughly investigate this proper balance between hardness and toughness that can be controlled to a large degree in the quenching and drawing temperatures was one of the outstanding reasons for the attempt to overcome this difficulty by adding to or increasing the alloying elements in high speed steels.

Surely it was an insistence on greater cutting efficiency that caused steel manufacturers to increase the vanadium content to 2% as is the case in the double vanadium steels. Doubling the vanadium content reduced the Rockwell hardness unless the carbon content was increased, and, while it is possible to harden the 18-4-1 type of steel to a Rockwell hardness of 64 or 65 with the recommended percentage of carbon between .65% and .75%, it was necessary to increase this percentage to between .75% and .85% to attain the maximum cutting efficiency possible with the added vanadium. With this increase of both carbon and vanadium, we retain the toughness required to support a fine cutting edge at a slightly higher Rockwell hardness. It is only in the last few years that the increased cutting efficiency of the 18-4-2 type of steel has been recognized. Experience with this type of steel has proven it to be superior for commercial purposes to the 18-4-1 type, and, while the cost is slightly higher, it is more than offset by its increased efficiency.

For many years cobalt has been added to high speed steels with varying results, resulting in a comparatively restricted usage of cobalt bearing analyses. There is no question of the value of cobalt additions on some applications, particularly on heavy cuts in hard material where excessive heat is generated. Cobalt seems to increase the red hardness at which a tool will break down, and experience shows that this is the only desirable feature of a cobalt steel.

The first cobalt type of high speed steel marketed was of the 18-4-1 + 4% cobalt. One of the main objections to the cobalt type of high speed steel is its tendency toward a partial decarburization of the surface during the hardening operation. The depth and degree of this decarburization is proportional to the cobalt content when other factors are equal. However, much of this difficulty has been overcome since the advent of atmospheric controlled furnaces. Later an 18-4-2 + 8% cobalt became available, and this type of steel has become quite popular for many applications, particularly where heavy cuts in hard material at increased speeds are necessary.

There still were some applications where extremely heavy cuts in hard material caused rapid tool failure, such as removing a large amount of stock from a locomotive drive wheel tire which had become worn to a depth of as much as half an inch. Here we were not only confronted with the problem of removing a large amount of stock from a very hard, tough material, but also with that of a work hardening setting up an extremely hard surface. To cope with such extremely difficult jobs, an English manufacturer introduced into this country a super tungsten cobalt type of high speed steel containing approximately 12% cobalt in which the percentages of all the major alloys were increased. Due to the high percentage of all of the alloys and the extreme difficulty encountered in forging and rolling this type of steel, the price was extremely high, and its use was only warranted where all other types of high speed steel had failed. Many other applications for this type of steel have been found in the automotive and agricultural implement field where its use has proven economical. Principally due to the extreme high price of this steel in comparison to some of the more common brands, it is most difficult to convince the large portion of the users of high speed steel that the increased performance will justify the higher price. If all of these different types of high speed steels bore the same base selling price, it would be a much more simple problem to determine the relative merits of the different types. Naturally the lowest priced steel is going to be given the first and best consideration.

During the world war it became very difficult to secure sufficient tungsten to satisfy the needs of industry. Consequently the price of high speed steel went up to unheard of prices, some being sold for as much as $4.25 per pound. The price was eventually fixed by the government at $2.00 per pound. After the world war the Ordnance Department of the United States Army became actively interested in the substitution of molybdenum for tungsten in high speed steel. The department's investigations were carried out at the Watertown Arsenal, and were published in January 1930. These investigations proved that tools, completely satisfactory for practical purposes in high speed work, could be made by the substitution of molybdenum for tungsten.

As a result of this investigation, there was an increased interest shown in molybdenum high speed steel with the result that different opinions arose as to the possibility of a complete substitution of molybdenum for tungsten. Nevertheless great activity was shown in the development of molybdenum steels. In the year 1933 a patent was granted to J. V. Emmons and assigned to the Cleveland Twist Drill Company on a molybdenum tungsten type high speed tool steel which was later trade named "Momax." This type contained 8% molybdenum and 1½% tungsten. License was granted to several of the large steel manufacturers who immediately went into production on this type of steel.

The largest known deposits of molybdenum in the world are located in the United States, and while we have some scattered deposits of tungsten, the price of tungsten is controlled by the world market and naturally fluctuates in price according to world conditions. On the other hand, the United States is in a position to stabilize and control the price of molybdenum.

It has been quite definitely established that 1% of molybdenum is equivalent in alloying effect to 2% of tungsten, and, on this basis, the cost of the molybdenum alloy has a considerable advantage over tungsten. This cost reduction is reflected in the base price of the molybdenum steels to the extent of about 15c per pound. The difficulty with molybdenum high speed steels was the decarburization at elevated temperatures, together with the necessity of holding a more narrow range of quenching temperatures required to produce consistently uniform performance.

The decarburization problem was overcome to some extent by a method developed in the investigation at the Watertown Arsenal, by the free use of borax to protect the surface at decarburizing temperatures. This method was rather unsatisfactory and messy. The salt bath method of hardening was resorted to by many as a solution of this problem. Others have been able to overcome this problem by developing favorable atmospheric conditions in electric furnaces, and, while for a continued period of time the problem of decarburization was the outstanding objection to the use of molybdenum steel, it has now become of minor importance.

In the investigations of molybdenum high speed steel, it was found that the melting point of the carbides in this steel is about 150° F. lower than in tungsten steels. The molybdenum steels develop their secondary hardness and strength at about the same temperature as the tungsten steels, but the range of both hardening and tempering temperatures in which the best structures are developed narrower for

(Continued on page 26)

The Granidizing of Steel

By
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A Paper Presented Before
Chicago Chapter A.S.T.E.

ANYONE who works with metals as you all do, has run into the problem of corrosion. This problem is with us all the time. I shall also include wear. The metallurgist is interested in the manufacturing of metals. He is always up against corrosion. Corrosion might be thought of as the decay of metals. In other words, perhaps when this earth was made, all our metallic compounds were in the form of pure metals. We make metals out of these ores by reversing this corrosion process. But it seems that our product is always trying to get back to ore. The problem of corrosion is always one in front of us. It is a tough problem for engineers. Parts must be designed so that they are heavier for strength because of the weakening by contamination and corrosion. We all try to eliminate corrosion.

One of the most familiar methods in ferrous metals is the so-called group of stainless steels. How do they prevent corrosion? It is definitely accepted that stainless steels form a film on the outside surface. This film is a self-healing one. It protects the underlying metal. If there is any reason for this film being removed, the stainless steel is rapidly attacked.

Stainless steel has been used for many years in the Navy. They tried stainless steel tanks for storing gasoline on airplanes. Salt water was pumped in as gasoline was used. Tanks went to pieces in about two months time. They discovered that a small amount of sewerage from salt water entered these tanks and it reduced the oxide film on these tanks and they were rapidly attacked by the salt water.

For an example of corrosion resistant is the copper bearing steel. We find that 41% copper in steel gives about three to five times resistancy when exposed to the atmosphere.

Now we have the high silicon irons. These are alloys of iron and silicon. Usually extremely corrosion resistant. They are used where extreme corrosion resistance is necessary. One of the great drawbacks of these alloys is that they are extremely fragile. They cannot be machined very successfully. In spite of their high cost, where you have a tough corrosion problem, high silicon irons are very often used.

Since all corrosion resistance in the ferrous metals was due to oxidized films, each generated by the alloy underneath, it was not necessary to make whole pieces out of this alloy. Just enough to generate this outside film. This outside film had only to be very thin. If we could make an outside layer that could generate this film, we could make the rest of the piece out of a cheap piece of iron or steel. For a number of experiments we devised a method of impregnating iron and steel with silicon. It is the most inert of all elements that we know. Because of this inertness, it has endured through the ages. If we could impregnate the steel with silicon, this would generate the oxide film and work out very well.

In ordinary furnace equipment if some silicon carbide, which is used by all of you, is placed in the retort, and heated up to a high temperature, and a small stream of chlorine is introduced, it reacts with the silicon carbide at this high temperature and as the iron is in such a condition to absorb this silicon, it enters the outside layers of the iron. Then you have an alloy film on the outside.

I have here an ordinary bolt and nut. After impregnation, they have been cut in two with grinding wheel. One half has been boiled in nitric acid. By means of this impregnation of common iron and steel, we retain all the properties of the core material. A part can be machined as common steel, but if it is given this silicon impregnation treatment, it is much more difficult to machine. We then have the easy machinability of common steel and the corrosion resistants of high silicon irons.

When the piece is first cut, it shows no line of demarcation. It is an inner part of the piece. The part actually wears less after treatment than before. Some of the iron has been replaced with silicon. All of these parts have been machined and fabricated entirely before treatment. The original fabrication of parts still shows during the treatment.

The cost of processing is very low compared to any alloy of comparable corrosion resistant. Equipment used is ordinary carburizing equipment. Examples have all been treated about two hours. The material silicon carbide costs just about the same as carburizing compound. The job is done in the same equipment at the same cost cut in about a third of the time.

We have had a number of industrial applications that we have tried out and they have shown excellent results.

Nitralloy must be machined and then ground down for machining. This was changed over to silicon impregnation process.

These shafts I am now showing you are simply treated by the impregnation process eliminating one machining and grinding operation of that particular part. I am told that in about 2½ years they have never had one return on them.

Another practical example is conveyor chains. They are given about fifty times the life of the former chain that was used in this particular material.

In water pump shaft, much trouble was eliminated by silicon case which resisted wear very successfully.

For wear applications, we use more caution than for corrosion applications.

Another form of corrosion is the high temperature oxidization of metals. In some furnaces of high temperatures, the oxygen in the part unites with the metal and forms a scale on that particular part which keeps on growing and finally weakens the piece through this scaling. In this case it is best to step up the alloy content. This protects them against high temperature oxygen attack. The silicon alloys are especially effective against high temperature oxidization.

For high temperature resistants, the silicon case is also very effective.

In connection with wear, one property of this case is to absorb a small but appreciable amount of oil. Carbon does not exist as oil carbon or grinding carbon. When the silicon enters the steel, it is in the carbon that may have been present as conveyed into graphite.

Now the question no doubt is in your mind, what type of steel or iron is necessary for this particular process? We find that the best material is the ordinary carbon variety S.A.E. 1020 steel. It is the cheapest type of steel that can be bought. The sulphur content can be reduced to as low a point as possible. But in no event over the maximum allowed in S.A.E. 1020.

Because steels can be treated very readily we find that the higher the carbons in the steel the more difficult it is to cut. S.A.E. 1035 takes about twice as long to put the same thickness case as S.A.E. 1020 steel.

Any ordinary gray cast iron can be treated successfully by this method. Ordinarily, malleable irons do not treat as successfully as steels.

The Tool Engineer's Place in Industry

By
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A Paper Presented Before Syracuse Chapter A.S.T.E.

MR. HANCOCK

AVAILABLE records indicate that the first successful use of tools occurred about the year 1800, in England and in the United States. Although the first attempt to use tools in England was successful, they apparently did not follow through and the idea lay dormant for a period of time, but in the United States, the idea was followed aggressively by many New England concerns, particularly by those manufacturing firearms.

Until the late '90's, almost all tool makers designed the tools they made, having for a guide, a sample part or a parts drawing which was not always properly dimensioned. The tool maker was expected to design and build a suitable tool for the job. Although this method was crude as we look at it now, it was the start from which we derived the tool specialists of today, such as designers and engineers. The more experienced tool makers were in competition with each other in making tools that would operate successfully and at a cost that would show a profit for the job.

We do not have to go back beyond the days of the Spanish-American War to find that successful corporations did not furnish detail drawings or sample parts by which a tool maker could design and build a tool but they furnished a working model and sometimes a poor assembly drawing from which to work, the sizes and fits being left to the tool maker. From 1900 to 1915, at times we found men operating machines or doing bench work in the construction of tools, then transferring to a drawing board to design tools. At that time, there were very few tool makers or designers unemployed. The better men were willing to change from shop to Drafting Room as it gave them a good opportunity to actually see the results of their designs in real service. This experience was very beneficial to men of this type in their early years as several whom we personally know now hold executive positions in well-known industries.

About 1906 to 1912, the New England tool and contract shops were contacted by representatives of most of the automobile companies. Orders were placed for many special tools and fixtures in New England to be used in the Middle West for the manufacturing of automobiles. In these years, there were hardly enough tool makers available in Detroit and Flint, Michigan, to make the repairs on the tools which were in daily use on production jobs.

Tool Engineers' Recognition

England, Germany and other European countries soon abandoned their filing and fitting methods of manufacturing the lighter classes of machinery and other metal products and adopted the Yankee system of making parts that could be assembled without fitting.

Early Tool Engineering was not classified as such but as designing, however, in recent years, recognition has been given to Tool Engineering work required to design, build and successfully apply tools to present day manufacturing problems.

This is noticeable in two ways:

1. Large manufacturing companies have given greater emphasis to the place of Tool Engineers and Tool Engineering in their organizations.

2. The formation of a Tool Engineering society has given National recognition to the importance of the work being done by men along Tool Engineering lines.

Specializing in tool design may be said to be the first definite step toward Tool Engineering. This was brought about very gradually by the advent of quantity production, such as automobile manufacturing.

The World War created an emergency that made it necessary to hurriedly train men who could design tools and develop methods for making accurate and serviceable tools that could be depended upon to successfully meet the war requirements. The advent of the automobile on a mass production program created a condition requiring interchangeable assembly and a tooling program which made it imperative that new and better products be provided for the manufacture of components of the various assemblies without resorting to filing and fitting methods that had been one essential of most of the routines in previous years. Much progress has been made in the last twenty years in Tool Engineering but there is much unfinished work to be done. The opportunities for further advancement in this branch of engineering are unlimited.

We in the United States pioneered the interchangeable method of manufacture and mass production. The engineers in England, Germany, and other European countries quickly saw the advantage of Tool Engineering and made rapid strides in their tooling programs. The World War made necessary an extensive program of training Tool Engineers and providing better facilities for making tools. Designers as specialists were responsible for vast improvements in tool quality, which for many years represented the particular ideas for individual designers. However, in later years, research and development have led to better methods by standardization.

Greater Accuracy at Lower Cost Through Standardization

Even though greater accuracy in parts manufacturing has been required in the past few years, the parts are being made at low cost due to the vision and ingenuity of Tool Engineers who must look into the future and be prepared to solve intricate problems which present themselves in every day manufacturing. The enormous strides that have been made in manufacturing processes are "the work of man."

The standardization of tool parts such as die sets, die blocks, jig bushings, jig bodies, clamping and supporting members, etc., has greatly decreased the time and cost of building tools, although standardization of detail parts necessary in the construction of die work has not been carried as far commercially as the standard parts necessary in the construction of some other tools. The standardization of tool parts constitutes a profitable field for standardization within a company itself although a concern using standard commercial die sets must use die blocks, strippers, stock guides, etc., of other detail which can be quite uniform in size. The use of a considerable volume of die work will disclose the fact that many dies are build on a relatively few sizes of die sets. This gives a further opportunity for standardization.

In IBM, we found by a study extending over a period of two years that three sizes of die sets accounted for about 85% of our total die production. We also found that about 40% of die production was mounted on one of these three sets and as a result of this study, we are using a series of standard dies already mentioned. The use

of these standard details gives us the following advantages:

1. A material reduction in machining costs as standard details are ordered in lots of 25, 50 or 100, depending on the need for this particular detail.

2. A reduction in the time to build a given die as the die maker requisitions the standard details machined ready for actual use and does not need to start with rough material.

3. A closer control of estimated costs for building tools as fewer items and less machining are left to the die maker, his work being confined to the final machining and fitting where skill is a factor. We also found that this method of die building effected savings of approximately $7600 a year. By standardizing on jig and fixture parts along the same line as die parts, we were able to realize a saving of about $6,000 a year.

The Tool Engineer's Place in Industry

In my opinion, the best way to define a Tool Engineer's place in industry is to outline briefly the functions normally handled by a Tool Engineering department and to show the relations of Tool Engineering to other divisions of a manufacturing organization. These functions are as follows:

1. Preparation of information to guide model engineering departments as to the types of design most suitable for production.

2. Selection of manufacturing methods.

3. Designing of tools.

4. Supervision of building and testing of tools, drawings and specifications.

5. Preparation of routings.

6. Preparation of tool records and other essential shop data.

7. Preparation of tool and parts estimates.

8. Analysis of tool and manufacturing difficulties.

9. Preparation of information regarding manufacturing methods, costs, machine loads, etc., for the use of shop management.

A study of these functions will show that Tool Engineering must be in close contact with all divisions of a manufacturing organization and can render service to all. This service starts with the designing of a model and continues through until the tools have been proven by actual production runs. It continues beyond this point in solving difficulties which arise from time to time in the manufacturing of any product, and goes still further by the selection of improved methods of manufacturing. Tool Engineering can play an important part in the design of the product as it finally goes into production.

Model engineers can successfully design a machine from the standpoint of operation but the machine may not always be a success from a manufacturing or economic standpoint. It is obvious that a product must be made to sell at a price which will be in keeping with the service it offers. The design of a new product, therefore, offers two distinct engineering problems.

1. To design and build a unit which operates in a satisfactory way.

2. To revise or modify the design of a unit so that it can be manufactured at a cost which will enable the manufacturer to sell it at a price in keeping with its service.

The second problem is generally recognized as one best handled by men having Tool Engineering experience.

Product Designing and Today's Tool Engineer

Sometimes the amount of re-design required is limited and at other times, it is quite extensive. This re-designing is generally accomplished in one of two ways. At the completion of a model, the model and drawings may be submitted to a Tool Engineering or planning department for analysis. This analysis results in definite recommendations with respect to the design of the various parts and units to reduce manufacturing costs, tooling costs, or to improve manufacturing methods. It also includes recommendations which will improve the quality or operation of the product. The model with recommendations is then returned to the model engineering department for review and adoption.

The second method of handling this re-designing is to create a special production engineering department. This department consists of men who have had extensive tooling and manufacturing experience. The model with model drawings is then turned over to this department which assumes full responsibility for the re-design of the unit. This department makes the same type of analysis previously mentioned but undertakes the correction of drawings and specifications and places the unit in production without returning it to the Model Engineering Dept. where it originated.

The Tool Engineer of today recognizes that re-design of a product for manufacturing purposes offers one of his greatest opportunities. In fact, full advantage can not be taken of modern tooling and manufacturing methods without first revising product design to conform to these methods. Either of these methods outlined can be entirely successful in product re-design. The method selected should be based on actual conditions within an organization, however, one of these methods should be included as part of the manufacturing program in every company. In the selection of manufacturing methods, design of tools, preparation of routings and tool records, a Tool Engineer comes in direct contact with the production control and manufacturing divisions of a business. It is obvious that the successful operation of these divisions depends largely on the work done by the Tool Engineering department in carrying out these functions.

The basic factors which enable a production control department to maintain schedules must be considered and included in the tools at the times of design. This is also true of mechanical problems to be met in the manufacture of the unit. A Tool Engineering department furnishes the management of a plant with much of the essential information necessary to efficient operation. This information covers all phases of the manufacturing end of the business. For example, when a new model is being considered for manufacture, this department must furnish management with information relative to the cost of tooling and other equipment necessary to manufacture the unit as well as the manufacturing cost of the unit. On those units which are in production, it must keep management informed of new equipment and methods which will reduce production costs. It also serves management indirectly in studying and solving, with the help of the production department, the various manufacturing troubles which occur and thus insure absence of interference with production.

Tool Engineer in Key Position in Industry

A review of the functions of a Tool Engineering department and its relation to other divisions of a business indicates that today it occupies a key position in industry. Increasing credit is being given to the Tool Engineer for the success of quantity and quality production. It is becoming more and more apparent that the success of quantity and more apparent than that the quality production depends fully as much on sound tooling and manufacturing methods as upon the original design of the product itself. Tool Engineering, however, has by no means been completely covered nor have all the problems presented to the Tool Engineer been solved.

Problems

The trend of labor and material costs for many years has been on the upgrade. One of the most effective ways to offset this trend and enable the manufacturer to maintain or lower costs is by effective Tool Engineering and the resulting improvements in tooling and manufacturing methods.

Most progressive manufacturing organizations recognize Tool Engineering as one of the most effective means of accomplishing this purpose and are giving greater recognition to this field of endeavor. Under the present day method of mass production, Tool Engineers and designers, when designing tools, must thoroughly consider that the personnel using these tools are not trained mechanics but machine operators and tools designed for these men to use should be so designed that they can be easily and conveniently loaded and unloaded. Another thing of equal or greater importance to keep

(Continued on Page 28)

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Production Perspectives

News of Mass Manufacturing from Everywhere

Mid-West

Organization for the **1939 Machine and Tool Progress Exhibition** in Detroit in March got **under way** during the past thirty days with the approval of the show and preliminary details by the Board of Directors, American Society of Tool Engineers. A bare two weeks after the first official announcement—**four months prior to the opening of the 1939 Machine and Tool Progress Exhibition** to be held in Detroit's Convention Hall, March 14 to 18—**reservations for exhibit space have already passed the total exhibits of the 1938 show.** Most of the space so far, according to Ford R. Lamb, Executive-Secretary, has been taken by last year's exhibitors. "As a matter of fact," Mr. Lamb stated, "we have not sent out reservation blanks as yet except to those companies who exhibited last year or who did not manage to get ready in time for last year's show. This year we decided to start early so as to give manufacturers more time to develop operating exhibits of interest to Tool Engineers." **The exhibits will cover all forms of machines, tools, equipment and processes of interest to the manufacturing executives in the mass production industry. Floor space contracted for by The Society for the exhibitors totals more than three times the amount of space which was available for exhibitors last year. Plans** are also **being made to accommodate fifty thousand visitors** as it is anticipated that the convention and annual meeting of the A.S.T.E. will more than double in attendance that of last year—a not unreasonable expectation in view of The Society's growth **during the last twelve months.** During that time **the membership has doubled, chapters** have been **added in** such important industrial centers as **Cincinnati, Schenctady, St. Louis, Syracuse, York (Pennsylvania), Dayton, Philadelphia and Rochester, with Peoria (Illinois), and the tri-cities of Rock Island, Davenport and Moline (Illinois), about to be chartered as this is being written.** It has also been announced that the 1939 Machine and Tool Progress **Exhibition will be extended from four to six days.** A preview and reception is scheduled for Monday, March 13, at which time the important industrialists, legislators, educators and economists, the outstanding citizens of the nation, will be the specially invited guests of The Society to view the progress made in the development of machines, Tool processes and methods of production, as well as to attend **a formal banquet, Monday evening, March 13, at which time the American Society of Tool Engineers will have considerable and important data and information available, the importance and ramifications of which are of vital interest to all Tool Engineers everywhere.**

The **Nash-Kelvinator Corporation re-employed an additional 1,000** men **late** in **October** at the Racine, Kenosha and Milwaukee plants. **On November 15, it was planned to employ another additional 1,000 men bringing the total employed up to 7,000** in these three plants of the corporation.

Steel ingot production has been rising. Two additional blast furnaces were put into operation at the Chicago district plants of Carnegie-Illinois Steel Corporation early in November. One of the furnaces is at the South Chicago plant and the other at the Gary works. **This production boost was attributed mainly to increased purchases by the automobile industry.**

The **tractor division** of the **Oliver Farm Implement Company** has announced that **three hundred fifty men have been re-employed.** This brings the number of employed to nine hundred, equalling the number employed in the tractor plant at Charles City, Iowa.

The National Machine Tool Builders Association reported that the **October index of machine tool orders stood at 118.1,** a slight **advance from September's index** of 117.4. An **increase in domestic business,** the Association said, was offset by lower volume of foreign orders. **The 118.8 average for the last three months compares with the five-year, 1933-1937 average of 96.6.**

Mr. **George H. Spencer** has **joined** the **Bantam Bearings Corporation** of South Bend, Indiana, a subsidiary of the Torrington Company, Torrington, Connecticut, **to take charge of the New England district** and also to act as paper machinery specialist for the products of both organizations.

It is with deep regret that we announce the **death of Frank G. Payson, 65, former manager for many years of Logansport Machine, Inc.,** Logansport, Indiana. **Mr. Payson died November 4.** For many years Mr. Payson headed the Frank G. Payson Sales Company of Chicago. He then became the sales representative for Logansport Machine, Inc., later being advanced to the position of general manager. **He served** in that capacity **until October 1, 1937, at which time ill health forced him to retire.** He was well known and liked by his Tool Engineer friends everywhere.

Lewis H. Brown, president of Johns-Manville Corp., recently **proposed** the following **"creed of management"** at the seventh International Management Congress. **"We, whose responsibility it is to supply the needs of the public for goods and services** and who recognize our obligations to stockholders and employes, **believe: That we should constantly seek to provide better values at lower costs so that more of our people can enjoy more of the world's goods.** That we should **strive to develop the efficiency of industry** so as to earn a fair return for the investing public **and provide the highest possible reward for the productivity of labor. That we should stimulate the genius of science** and utilize the methods of research **to improve old products and create new ones so as to consistently provide new fields of employment for the present and coming generations. That management should encourage fair trade practices in business which, whether affected by competition or co-operation, will be so shaped as to be for the best interest of our customers and of society as a whole.** That it is management's duty to be alert to its own shortcomings, to the need for improvement, and to new requirements of society, while always recognizing the responsibility of its trusteeship. That business in this country has never been what it could be and never what it yet will be. **That business, labor, government and agriculture, working hand in hand, can provide jobs and the opportunity for all to work for security without loss of our liberty and rights as free men."**

East

New England manufacturers have been **engaged** for two years **in a large spending program which will continue through 1939,** it has been disclosed by the New England Council and the Engineering Societies of New England, Inc., Boston, **following a joint survey of modernization activities** in the major New England industries. Sums ranging from $1,000 to more than $1,000,000 have been spent since the latter part of 1936 by manufacturers in all six States in an effort to produce higher quality products more efficiently and at less cost to the ultimate consumer, the survey revealed.

The survey, conducted in the form of a series of self-analysis questions, **showed that the majority of the manufacturers are directing the spending program in modernizing and replacing out-moded machines and equipment, designing and installing special machines for specific operations and redesigning products to meet competition from other areas.**

New England industries reporting large spending and modernization programs, included metal products, textiles, machinery, paper, woolens, furniture, printing, food products, shoes, chemical and granite. One metal manufacturer reported spending $500,000 in two years.

One of the most encouraging reports came from a machine tool manufacturer who reported modernization expenditures, amounting to $1,400,000, with an additional $400,000 expenditure contemplated for the construction of a new plant. Other machine tool manufacturers reported expenditures ranging from $12,000 for the installation

(Continued on page 34)

Chapter Doings *by Geo. J. ("Jitter") Keller*

WELL, well, well, your Columnist made the News on November 12th, when he helped himself to a 36½ pound muskellunge 47½ inches long in Ye Old Niagara River. Believe me, that's some fish for a rank amateur. Some of my very good ASTE friends seemed somewhat skeptical and I was made to take a lot of ribbing but when they saw the actual proof, their faith in fish stories was renewed. I knew all the time that it was just enviousness on their part and the Green Eyed Monster had gotten the best of them.

George Keller, editor for this feature in "The Tool Engineer," sent this photograph to prove he really caught the fish he has been "ribbed" so much about.

On Thursday, November 10th, **Detroit** Chapter, 225 strong, migrated to Pontiac, Mich., to inspect the plant of the Yellow Truck and Coach Div. of General Motors. Dinner was served in the plant dining room and was followed by a rather lengthy business discussion in the Auditorium. W. A. Rech, Personnel Director, gave the welcoming address and introduced Mr. Lindegrin and the YT&C male chorus and Ben Franklin, tenor soloist, who sang several numbers. R. J. Emmert, Factory Manager, gave a short talk while W. F. Wagner, our well known prexy of ASTE, gave a speech which left the impression that he has no time for any organized group which tries to discourage tool and machine development. W. E. (Pinky) Moody, Asst. Factory Manager, spoke on "Development of Yellow Truck & Coach." Stanley Tuttle, Project Engineer of Diesel Engine Div., showed a sound motion picture on the Diesel Engine made by his division. L. B. Gatley, Asst. Personnel Director, made the arrangements for the plant tour. Hans Schjollin, Engineer in Charge of the development of the Hydro drive for Diesel engines, explained his project in one of the experimental garages. On a whole, the November meeting was one of great interest.

Our **Philadelphia** chapter comes marching along this month behind their new 10' x 16' flag, telling us of their well attended meetings for the past three months and some of the real things they have accomplished and all the time we thought they had started to hibernate way back in September. At their September meeting 127 dinners were served and 200 attended the meeting. M. W. Dalrymple of Bethlehem Steel gave a talk on "Properties of Tool Steels." At their October Meeting, C. W. Lucas of Ferracute Machine gave a talk on "Press Work and Press Work Pressures." He was assisted by C. Paul Denckla of the same company. Approx. 230 attended this meeting. At the November meeting, Philadelphia had as a guest speaker F. W. Hammer, Warner & Swasey expert who spoke on "Turret Tools, Standardization of Turret Tools and their application to the industry today." Mr. Bailey, Asst. Sales Mgr. of Warner & Swasey Co. also attended this meeting. I understand they have some real harmonizers down in Philadelphia. Maybe we should have an A.S.T.E. chorus?

Bridgeport had one of its best meetings on November 10th at the Stratfield Hotel. Chairman Dundore gave a "swell" account of his trip to Pittsburgh. George Mencke of Vascoloy Ramet Corp. gave an interesting talk illustrated with slides showing machineability of materials with tungsten carbide and high speed tool steels. A.S.T.E.er Frank Whelan, heeding the suggestion of Ford Lamb, has started a speakers' class. Many members signed up. Mr. Whelan offered his services absolutely free. Ben Page has a large group of Boy Scouts under his wing and A.S.T.E.er Lloyd addressed Ben's proteges on Stamp Collecting. Wonder where Ben gets all the time to attend to his many activities? By the way some new members were brought in and the membership committee, headed by Stephen Lasto, tells us that's only the beginning. Good work, Stephen.

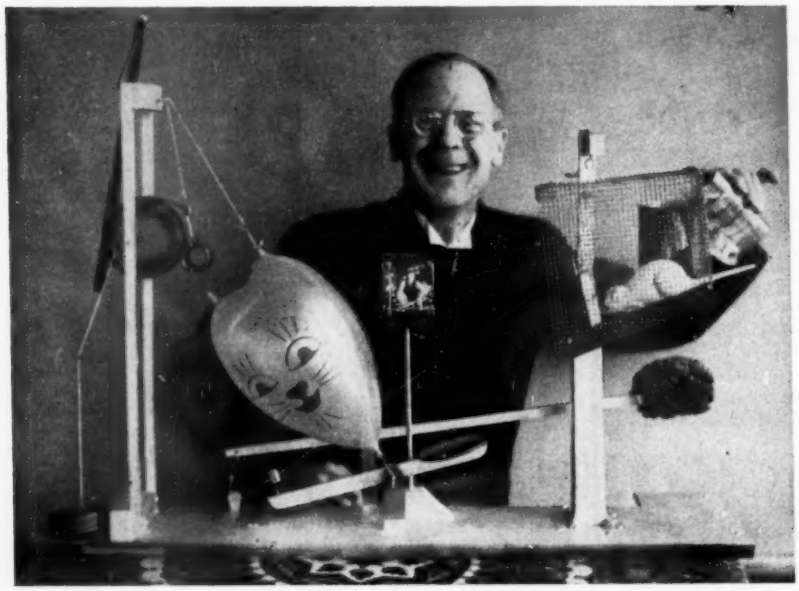
Our **N.Y.-N.J.** chapter crossed the 200 mark on its first anniversary. When they founded their chapter they had less than 50 members. That should give the rest of the chapters something to think about. Jim Weaver came up from Pittsburgh to "blow out the candle on the keg of beer." Speaker of the evening was Henry Kurtz, Optical Engineer of the Bausch & Lomb Optical Co. of Rochester. His talk was very enlightening and the birthday meeting was a big success.

Pittsburgh's Chapter doings this month read like Walter Winchell's column. W. K. Bailey, Asst. Sales Mgr. of Warner & Swasey Co., gave the address at their November meeting. I. M. Dinger, program manager, introduced the speaker and gave a pep talk to the members. He sure is a dinger! Harry Barney had as his guest, W. J. Hannum, Sales Mgr. of Gisholt Machine Co. The Railway Industrial Eng. of Greensburg was represented by Walter Lister, J. S. McGill, A. T. Pegg, L. J. McKim and R. E. Cope. Albert Helquist was there with his dad, J. L. Helquist. Albert is an apprentice at the Pittsburgh Equitable Meter Co. Chairman Grace reported on the Pittsburgh semiannual meeting. R. E. Riseley, an old member, also paid a visit. He is now located in Bradford, Pa. R. W. Ford had some good ideas for a Christmas party. Maybe they could dress Harry Barney up as St. Nick.

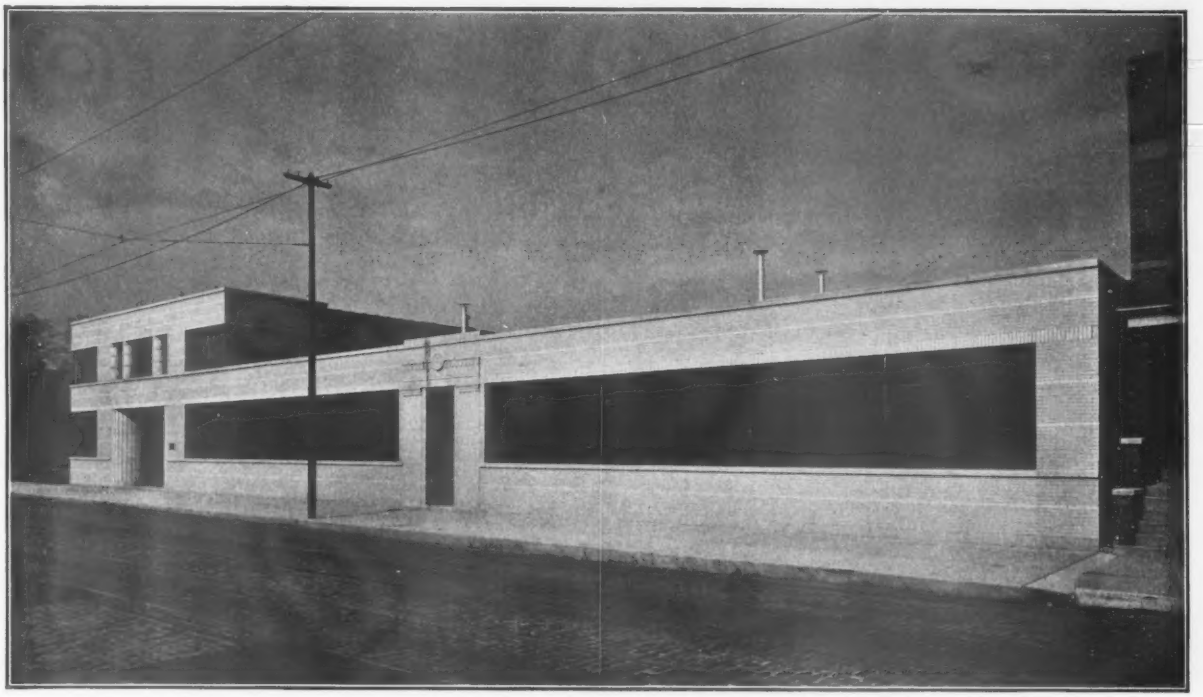
Hartford's November meeting was a dinner meeting at the City Club with 75 present for dinner and 200 for the technical session. Evidently some of the A.S.T.E.ers still prefer home cooking.

(Continued on page 22)

Prof. R. E. Oakes, inventor, entertainer supreme of Rockford Chapter, A.S.T.E., has "lectured" to the boys there on his various "patents." Below he is shown with his patented "Hydraulic Cigarette Lighter," which, it appears, outdoes Goldberg in ingenuity and intricacy of mechanism.



The New Home of BESLY TITAN ABRASIVE WHEELS



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Write for your copy of Booklet on Besly Titan Steelbacs.

Order your wheels for Disc Grinders, Blanchard, Pratt & Whitney, Osterholm, Diamond and other face grinding machines from Besly, the outstanding manufacturer of that type of grinding member. • Acquaint yourself with the advantages of these modern Besly Titan Steelbac Abrasive Wheels which have so rapidly replaced the older type grinding members.

CHARLES H. BESLY AND COMPANY

118-124 NORTH CLINTON STREET ★ CHICAGO, ILLINOIS

(Continued from page 20)

Chris H. Borneman, Supervisor of Tool and Gage service, Schenectady Works, General Electric Co., gave a splendid talk on the modern method for systematically servicing both tools and gages in a huge plant. Many of their local men tried to "gang up" on Mr. Borneman during the question period. but Chris had all the answers. Hartford expects to be back in its old meeting place, namely the Gas Company's Auditorium next month. Damage by the flood has been fully repaired. Hartford, by the way, added 30 new members this season due to the sincere efforts of Albert Englund, Chairman of the Membership Committee.

Dayton Chapter met in the Gibbons Hotel on Monday, November 14th. Speaker for the evening was Herman Goldberg, Supt. and Ch. Eng. of the R. G. Haskins Company. He spoke on taps and tapping machines. Robert Ziegler was appointed Chairman of the Public Relations Committee. Earl V. Johnson reported on the Semi-annual at Pittsburgh. Dayton has reason to boast that every one of its officers attended this meeting.

Buffalo's November meeting was a dinner meeting at Lorenzo's Restaurant. Otto Winters opened the meeting by introducing his Great Dancing Impersonator which I am told cost him the sum of one dime. Chairman Howard Taylor told of his trip to Pittsburgh. The speaker of the evening was A. H. d'Arcambal of Pratt & Whitney, who gave a real talk on "Cutting Tools." Buffalo added 3 new members at this meeting.

Baltimore Chapter's November meeting was a dinner meeting at which W. W. Broughton of the New Jersey Zinc Sales Co. enlightened them on the subject of die casting. Also at this meeting was one of the members who has carved for himself a niche in the sporting hall of fame. Pat Dengis as a marathon runner will long be remembered in sporting circles. His career began at 32 when most runners are finished. He has copped 4 national championships.

The November meeting of **Chicago** Chapter was held November 7th at Harrison's Restaurant. There was a good turnout and an excellent discussion on thread grinders. This discussion was presented by Ira J. Snadin, research engineer of the Ex-Cell-O Corp.

Syracuse held its meeting November 9th and guest speaker for the evening was A. H. Hancock, Gen. Supt. of the International Business Machines Corp. at Endicott, N. Y. Mr. Hancock brought a large delegation of his tool designers and shop executives with him and the whole group was photographed. This photo with a complete writeup about our society will be published in the International Business Machine Corp. monthly newspaper which is distributed all over the world.

Toledo reports that its November meeting was strictly a business meeting.

St. Louis Chapter held its Nov. 3rd meeting at the North Side Y.M.C.A. Their speaker was J. C. Fox of the Doehler Die Casting Co. This was a dinner meeting, well attended and very inspiring. Much credit for this swell meeting goes to H. O. Woerner of the Doehler Company.

Once again **Rockford** comes thru with a bang-up meeting on October 20th at the Faust Hotel. They sure are doing things out Rockford way. Over 150 for the dinner and over 350 by the time the technical session began. There were some grand displays, and speakers for the evening included W. H. Oldacre, President of the D. A. Stuart Oil Co., Prof. R. E. Oakes and George C. Johnson, Chairman of Rochester Chapter. Favors and music led by Ernie Ekstrom added to the dinner. Mr. Oldacre gave a very interesting talk and then they went from the sublime to the ridiculous in the personage of Prof. Oakes from Waukesha, Wis. Equipped with a monocle, he proceeded to inform the A.S.T.E.ers "How to become an inventor." My spies tell me he had them rolling in the aisles. Rockford suggests other chapters, who might find their meetings becoming somewhat dry, get in touch with Prof. Oakes, Ace of entertainers.

One hundred and thirty Engineers attended the dinner lecture meeting of Racine Chapter, Nov. 14th at Hotel Racine. Speaker at this meeting was D. A. Rogers, Pres. Dayton Rogers Mfg. Co., Minneapolis, Minn. His topic, "Economical Production of Metal Stamping in Small Lots," was of great interest. An added feature during the evening was several movie films shown by Gene Zimmerman of the Illinois Tool Wks. Of special interest was the one which covered outdoor activities during the annual frolic held by the Racine Chapter last June.

Rochester A.S.T.E.ers, 150 strong, waded through snow and ice for their November meeting. Speaker was A. H. d'Arcambal, consulting metallurgist and Tool Engineer. Walter Roe and Tom McMichan of the American Locomotive Plant, Auburn, seemed to have done a little surveying of surrounding territory before reaching their destination. C. R. Ainsley of Syracuse Chapter took the long distance prize when he braved 90 miles of slippery and snow covered roads to attend this meeting. This only goes to show what our A.S.T.E.ers are really made of.

Milwaukee broke loose at its November meeting, breaking all records for attendance. One hundred and eighty members were present, including those from LaCrosse, Green Bay, Racine, and Wausau. That's the stuff, Chairman Rutzen! Chrysler Motors held the spotlight with Super-finish. Foster Koehn promises a real bang-up time for the December meeting. We hope Myron Gettelman of LaCrosse and Gideon Kane of Green Bay will come again.

Friday night, November 18th, was a big event for **Cleveland** A.S.T.E.ers. They joined the Navy to see the world and they saw the sea. The sound movie of Naval maneuvers gave them a different impression of our front yard defense line. Believe me, the Navy can give a good account of itself on the sea, under the sea, and in the air. The making of warsmen and the training of men is a fast growing branch of the Navy through the air corps. Thanks to Chief Water Tender Carnes for his interesting talk previous to the picture. He was ably assisted by Chief Machinist's Mates Sweasey and Drees. "Porthole Pete" Harry Sauer braved the driving all the way from Kent to attend the meeting. Frank Snyder and George Dort of White Motor Company and Tom Krivanek, Brush Development Co., and Emil Bodendorf, General Elec. Co., were present. Come again, fellows. Frank Denning of Denning Mfg. Co. has the record for the best attendance. He is our biggest booster and a stranger to no one. Don't forget the Christmas Party on December 16th. Tickets are on sale, and you better come. Jack Hawkey forgot to give us the name of the meeting place. Are we glad!

A student chapter of the American Society of Tool Engineers was given its charter Wednesday, November 2, in **Cleveland.** The chapter is the second student organization set up, a similar chapter having been formed in Detroit some time ago. The student chapter will operate under the direction of the officers of the regular Cleveland Chapter, A.S.T.E.

Thirty-four technical students at Fenn College formed the Charter membership of the group, which will be extended to include other technical schools in the Cleveland area.

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Correct hob-sharpening in the tool-room means better work in the production departments, more pieces per grind, less grief. . . . Means lower costs on both sharpening and production.

For correct and most economical sharpening of hobs and formed milling cutters, either straight- or spiral-gashed, first bring tools to fixed uniform temperature; then sharpen on Barber-Colman Automatic Hob Sharpening Machines. Built in two sizes, these machines are extremely accurate, absolutely reliable, easily set-up, automatic after starting, most economical to operate.

For smaller volume, wider scope, use the Barber-Colman Combination Sharpening Machine which has hand-indexing and manual feed, handles any make of reamer, as well as milling cutters and hobs.

For complete information on these Sharpening Machines write to our Engineering Department, Section T.

Number 3 Hob Sharpening Machine, shown above, has capacity to 4" dia. by 4" face. Number 4 takes 10" by 12".

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December Chapter Meetings

Chapter Meeting Announcements must be received on or before the 20th of preceding month to appear on this page. Members and friends of The Society contact Chapter Secretaries for meeting details if your announcement does not appear below.

BALTIMORE

December 12, 1938—Dinner, 7:00 P.M. Technical Session, 8:00 P. M. Sears, Roebuck Auditorium.

Speaker: S. A. Brandenberg, Monarch Machine Co.
Subject: The Development of the Lathe.
Reservation: Nils H. Low, 3815 Glenmore Ave., Baltimore; Hamilton 0851.

BRIDGEPORT

December 8, 1938—Mary Journey's Inn.

Dinner Meeting: Details will be in Secretary's meeting notice.
Speaker: Mr. K. C. Munroe, Chief Engineer, The Lapointe Machine Tool Company
Subject: Developments in the "Art of Broaching"
This meeting will be a pre-Christmas party with door prizes and a gala time.

BUFFALO

December 12, 1938—7:00 P.M. sharp. Touraine Hotel, Delaware Ave. and Johnson Park.

The Allen Manufacturing Company of Hartford, Conn., will show a picture titled, "A Ticket to Continuous Performance," showing methods used in the manufacture of hollow screws as well as their application in machine tools.
Reservation: Mr. Wm. Weinreich, 649 Minnesota Ave., Buffalo, N. Y.

CHICAGO

December 5, 1938—6:30 Dinner, price $1.15. 8:00 Technical Session, 25c admission if you don't attend dinner. Harrison's Restaurant, 80 E. Jackson Blvd., Chicago.

Speaker: Mr. A. W. F. Green, Product Engineer of the Allegheny, Ludlum Steel Company
Subject: "Steels of Today and Tomorrow" accompanied by a Color Motion Picture.
Mail Reservation to Harrison's Restaurant, 80 E. Jackson Blvd.
Also a movie will be shown entitled "Hunting and Fishing in Alaska."

CINCINNATI

December 13, 1938—Ohio Mechanics Institute, Whetstone Hall.

Speaker: Hans Ernst, Director of Research, Cincinnati Milling Machine Company.
Lunch and beer afterwards. 50c.

CLEVELAND

December 16, 1938—7 P.M. sharp. G. T. V. German Club, 1616 East 55th St.

Annual Christmas Party.
Full course dinner $1.50 per plate.
Dancing, entertainment, prizes and favors for all.

DAYTON

December 12, 1938—6:30. Master Electric Co., Dayton, Ohio.

Speaker: T. Barish, Assistant Chief Engineer, Marlin-Rockwel Corp.
Subject: "Ball Bearings and Their Application."
Reservation: By card or Walter Olt, Fu 3113.

DETROIT

December 8, 1938—Dinner, 6:30 P.M. Technical Session, 8:00 P.M. Intercollegiate Club, Penobscot Bldg. Guests welcome. Price, $1.50.

Speaker: Mr. D. A. Wallace, Pres. Chrysler Div., Chrysler Corp.
Subject: "Super-Finishing." Have machine on hand and plenty of samples to illustrate his operation.
Make reservations early by calling National Office.

HARTFORD

Monday, January 9, 1939.

Speaker: L. N. Kohl, Field Service Engineer Metallurgical Department Republic Steel Co., Massillon, Ohio.
Subject: "Fabrication of Stainless Steel." Splendidly illustrated by remarkable motion pictures.

MILWAUKEE

December 8, 1938—Dinner, 6:30 P.M. Republican Hotel.

Film: "Die Casting," Courtesy New Jersey Zinc Co.
Speaker: Mr. Arthur Peck, Milwaukee Die Casting Co.
Display: Dies and moulds and die castings.

MINNEAPOLIS

December 14, 1938—Dinner, 6:30 P.M. Meeting, 7:30 P.M.

Speakers: D. A. Rogers, Dayton Rogers Co.; Eric Wistrand, Minneapolis Honeywell Co.; A. J. Scheid, Columbia Steel Co.
Subjects: 1. Temporary Dies and Stampings. 2. Analysis of Dies and Troubles. 3. The Whys of Tool Steel.

NEW YORK-NEW JERSEY

December 13, 1938—Dinner 6:30 P.M. Meeting, 8:00 P.M. Robert Treat Hotel, Newark, N.J.

Speaker: Kirke W. Connor, President, Micromatic Hone Corp.
Subject: "Surface Finishing."
Reservation: Ben Broaheer, Medallion 3-0700.

PHILADELPHIA

December 8, 1938—Dinner at 6:15, Adelphia Hotel. Entertainment, 7:15. Technical Session, 8 o'clock.

Subject: "Manufacture and Uses of Stainless Steel" Technical Film through the courtesy of the Allegheny Ludlum Steel Company and their representative the Edgcomb Steel Company of Philadelphia, Pa.

PITTSBURGH

December 9, 1938—6:30 P.M. McCann's Dining Room.

Speaker: Geo. M. Mencke, Sales Manager, Vascoloy-Ramet Corp.
Subject: "Machinability of Metals."
Reservation: Call Miss Wingard, BR 1500, Ext. 9264 by Dec. 8, 1938.

RACINE

December 12, 1938—Dinner, 6:30 P.M. at Hotel Racine. Technical Session, 7:30 P.M.

Speaker: Mr. R. E. W. Harrison, Vice President, Chambersburg Engineering Company, Chambersburg, Pa.
Subject: "Drop Forging Practice."
Reservations: Contact Charles Merrill, phone J-632 or H. E. Munch, phone J-3513.

ROCHESTER

December 8, 1938—Dinner, 6:30 P.M. Meeting, 7:45 P.M. University of Rochester, River Campus.

Speaker: Hans Ernst, Research Director, Cincinnati Milling Machine Co.
Subject: "Physics of Metal Cutting."
Reservation: Dinner, 75c.
Rochester Chapter of Society for Metals join with us in this meeting.

ROCKFORD

December 8, 1938—Hotel Faust. Entire Eleventh Floor.

5:00 to Midnight: Educational exhibits.
6:15 Sharp. Dinner and entertainment. Assessment $1.00 per person. Make reservations by Dec. 6 to Allis Chalmers (Electrical Division) Talcott Building. Telephone Main 6270.
7:30: Recess.
8:30: Address by Lt. Col. A. B. Johnson, of Ordnance Dept.
Subject: "What Methods of Production Will be Used by the Government in Case of War."
Notice: Reserve Officers located in this area are invited to attend.

SCHNECTADY

December 6, 1938—Dinner, 6:00 P.M. Meeting, 8:00 P.M. Elks Club, Schenectady, N.Y. (Dinner and meeting.)

Speaker: Mr. Hans Ernst, Research Director, Cinn. Milling Mach. Co.
Subject: "Physics of Metal Cutting."
Reservation: $1.00 each. Call G. Murphy, Sec., G. E. Co., Schenectady, New York.
Guests invited.

ST. LOUIS

December 8, 1938—Dinner, 6:30 P.M. $1.00. Northside Y.M.C.A.

Speaker: Mr. Geo. M. Mencke, Vascoloy-Ramet Corp.
Subject: "Machinability of Metals."
Reservation: C. J. Steinman, Newstead 0800.

SYRACUSE

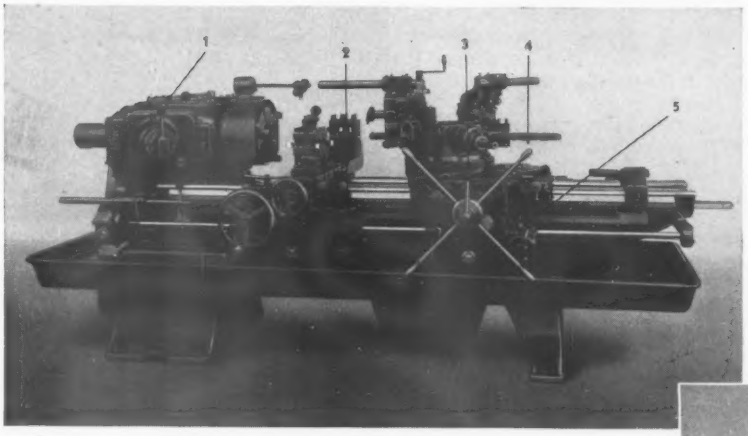
December 7, 1938—Dinner, 6:30 P.M. Talk, 8:00 P.M. Syracuse Industrial Club.

Speaker: Mr. Hans Ernst, Research Director of Cincinnati Milling Machine Co.
Subject: "Physics of Metal Cutting," with slides and motion pictures, the latter taken through microscope, probably with stroboscope lighting effects.
Reservation: To be made with Mr. Willard Parish, Crouse-Hinds Co., Syracuse, N. Y.

TOLEDO

The Toledo Chapter plans to dispense with a regular meeting in December due to the date conflicting with the Christmas holiday. Toledo Chapter extends its best wishes to its members and friends for a Merry Christmas and a Happy New Year.

HERE'S WHAT THE JONES & LAMSON UNIVERSAL TURRET LATHE WILL DO



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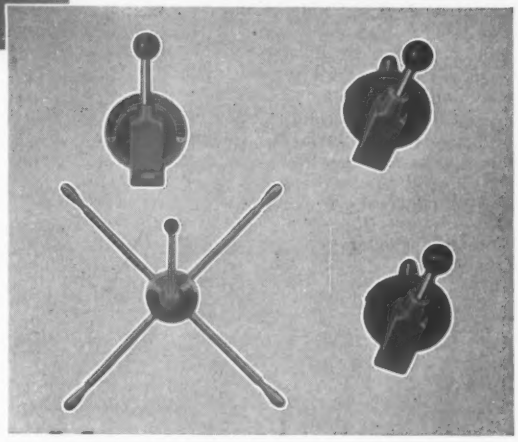

1 Improve the Quality of Your Product.

2 Increase Your Hourly Production.

3 Give You Maximum Earnings per Dollar Invested in Turret Lathes.

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THE PRODUCTIVE ADVANTAGES

Of the 49 Distinct Operating Movements Incorporated in 5 Control Levers

THE HEADSTOCK

12 Speeds.
1 Neutral.

THE CARRIAGE

9 Longitudinal Feeds.
9 Cross Feeds.

THE SADDLE

1 Right hand manual movement of saddle.
1 Left hand manual movement of saddle.
1 Right hand power traverse movement of saddle.
1 Left hand power traverse movement of saddle.
1 Slow speed power traverse movement of saddle.
1 Unclamping of turret clamp ring.
1 Withdrawing of turret locking pin.
1 Power indexing of turret.
1 Reclamping of turret clamp ring.
9 Longitudinal Feeds.

Total 49

IN purchasing a Turret Lathe, the selection should be based on the earning power per dollar invested, and on the knowledge that the machine has ample speed, power and rigidity to meet present-day requirements with a reserve for future developments of cutting tools.

JONES & LAMSON MACHINE COMPANY

SPRINGFIELD VERMONT

DEVELOPMENT OF H. S. S.

(Continued from page 13)

the molybdenum than for the tungsten steels.

In spite of the stand by some authorities that types of steel where molybdenum entirely replaced tungsten were unreliable, we now have several manufacturers marketing a molybdenum vanadium type of high speed steel, containing approximately 8% molybdenum, 4% chromium and 2% vanadium. The characteristics of this steel seem to compare favorably with the molybdenum tungsten types, and there is reliable information that in some applications it has a slight advantage. One of the outstanding conclusions in reviewing these many investigations on the molybdenum type of high speed steel is the modesty of the investigators in their claims as to the relative performance of the molybdenum steels against the tungsten types. In all instances they have said that it was comparable to the 18-4-1 type or slightly better, while many comparative breakdown and endurance tests have shown performance in favor of the molybdenum steels well above the average of the 18-4-1 type. There are many instances, especially on intermittent cuts, where the molybdenum steels have doubled the performance of the 18-4-1 type.

The prospect of developing a superior high speed steel that could be offered at an attractive stable price has encouraged many investigations as to the possibility of the addition of cobalt and other alloys to the molybdenum types of steel. Already one manufacturer is offering a molybdenum tungsten cobalt type of high speed steel with approximately 4% cobalt. This steel is the molybdenum equivalent of and comparable to the 18-4-1 plus 4% cobalt type of tungsten high speed steel.

Other investigations are being conducted as to the possibilities of improvement by the addition of copper up to 2½%. In this type of steel relation between the molybdenum and tungsten content has been changed to equal portions of each, or approximately 6% molybdenum, 6% tungsten, 4% chromium, 1.75% vanadium and 2.50% copper. This steel also shows considerable merit. Still another molybdenum steel has been developed containing 8% molybdenum, 4% chromium, 1½% vanadium and 8% cobalt with a small addition of boron.

The reason for the addition of either copper or boron is primarily to prevent decarburization while forging, rolling and heat treating this type of steel. Although the problem of decarburization during heat treating has become of minor importance, it is still of major importance during the forging and rolling process. In these investigations it has developed that the addition of either one of these alloys, copper or boron, will definitely prevent decarburization. This is true not only in forging and rolling but also in heat treating. There is considerable difference of opinion as to the practicability of the use of copper in high speed steel for fear of contaminating high speed scrap. This objection apparently does not arise from the use of small percentages of boron, and, while it is quite generally agreed that the addition of copper in no sense improves the cutting efficiency when added to high speed steel, there is much promise that the boron addition definitely improves the cutting efficiency.

It is definitely established that the molybdenum types of high speed steel, although showing comparable Rockwell hardness at approximately 150° lower quenching temperatures, still retain approximately the same red hardness as the tungsten types. The last mentioned type of molybdenum high speed steel, containing 8% molybdenum, 4% chromium, 1.50% vanadium and 8% cobalt with a small addition of boron, compares favorably with even the high cobalt tungsten type of high speed steel on difficult jobs.

A series of tests was conducted during the Machine and Tool Progress Exhibition at Detroit during March, 1938. The purpose of these tests was to compare, by means of break-down, eleven high speed steels having the general compositions shown in Table No. 1. Since the object of this study was to compare the structures and cutting properties of several high speed steel analyses rather than the respective properties of high speed steels produced by several manufacturers, the trade names of the steels were omitted. Table No. 1 also shows the present base price of the different types of steel. The price of the steel has to be given consideration when comparing relative values from an economic standpoint. This range of price varies from 54c base on steels No. 6 and No. 7 to $2.42 base on steel No. 5.

Many times it is possible to convince a production department of the superior performance of a high priced steel, but it requires the highest degree of salesmanship to obtain an order from the purchasing department covering tools made of a high priced material.

Table No. 2 is the heat treatment and hardness chart of the tools used in this test. There is a variation in quenching temperatures for the different types of steels, but the drawing temperatures have been the same for all types. The table shows the Rockwell hardness "as quenched" as well as "as drawn." Comparing these two columns it is apparent that, while some types increase materially in Rockwell hardness "as drawn" over the Rockwell hardness "as quenched," the opposite is true in other types.

Figure No. 1 shows the shape of the tools used in this test. A ½" square tool bit approximately 4" long with the entire form accurately surface ground was used. When resharpening, the entire nose was cut off the tools, and the form reground. Care was taken to avoid burning.

Run No. 1 shows the results of the first six tools of each type recorded in surface feet per minute at which the break-down occurred. The last column on this chart shows the average of these first six tools.

Run No. 2 shows the results of six more tools of each type, with the exception of No. 5 and No. 7 steels. The last column shows the averages of these six tools.

Run No. 3 shows the result of six more tools on types No. 4, 5, 6, 9, 10 and 11 with the averages in the last column.

Table No. 3 shows the average of all the tools run in the test with the number of tools of each analysis tested.

In order to develop a proper heat treating cycle for each of the steels to be tested, a preliminary series of hardening tests was conducted for each analysis. From a stock bar, 8 samples $\frac{9}{16}$" square x 1" were cut, ground on all four sides to approximately $\frac{17}{32}$" square to remove scale and decarburization, properly stamped for identification, and quenched from four different temperatures within a 75° range; as for instance 2300, 2325, 2350 and 2375° F. Four of eight of the samples of each analysis were left in the "as quenched" state, the other four being drawn at 1050° F. for 2 hours. The heat treatment of all test pieces and tool bits was carried out in regular production, electric hardening furnaces in a controlled atmosphere. These samples were polished, etched, and microphotographed to ascertain which treatment gave the best structure.

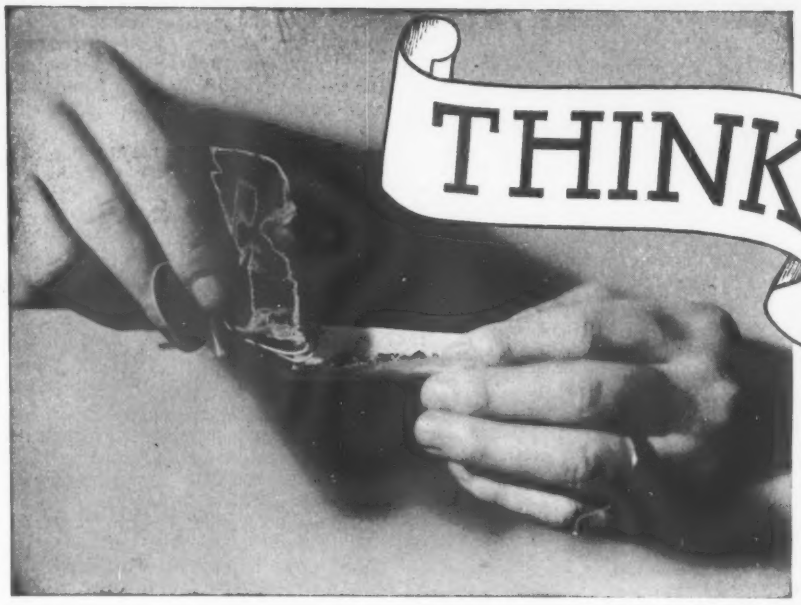
It is not intended to convey the impression that solely on the basis of structure can one predict the serviceability of a tool. It is established, however, that a study of the structure will often reveal what factor or factors need to be altered to improve the cutting properties of a high speed steel.

The work already done on the classification of high speed steels and the possible applications of these steels is merely a drop in a bucket compared to the objective that might be attained if an aggressive organization like the A.S.T.E., with a deep concern with the subject, could see its way clear to use this work as a basis for further standardization.

By insisting that a uniform method of identification be established for all analysis of high speed cutting steels, and plainly marked by the manufacturers of metal cutting tools, a series of endurance cutting tests could be conducted on the machining of all types of production steels that would eventually prove conclusively the relative values of the different analyses of high speed steels from an economic standpoint.

When and if such a program could be completed, Tool Engineers would be

(Continued on page 37)

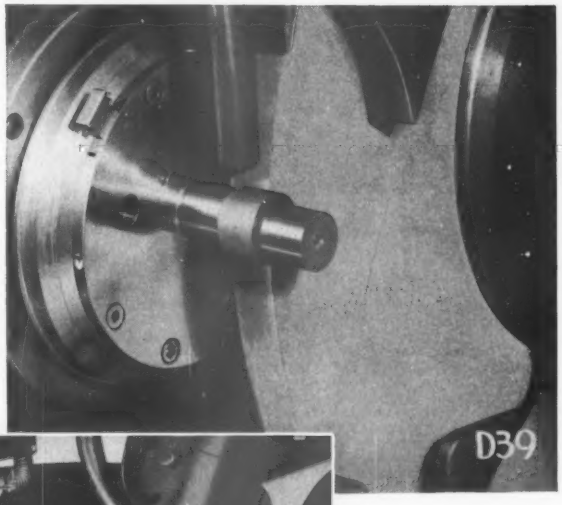


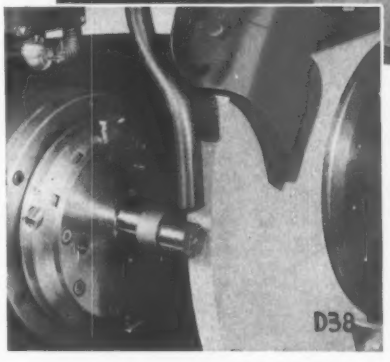
— ONE FORTIETH THE THICKNESS OF A CIGARETTE PAPER

Some things are difficult to visualize. Take this matter of accuracy. Four tenths of a tenth looks like this—.00004". It also looks like 1/40 the thickness of a cigarette paper.

That's really getting down to fine points which is just what a certain Landis Grinder is doing. On the job referred to a 10" x 18" Type C Plain Hydraulic is grinding the two eccentrics of a compressor eccentric shaft holding concentricity and taper within .00004". Nor is that all. Throw is held within .0001" and plane within .00015". Stock removal is .004". No lapping operation is required.

The above limits are unusual. More important still, they are maintained consistently on a production basis. Maybe you would like to grind some of your parts just as accurately but have not been able to do so. Bring your problem to Landis where years of wide and varied experience will immediately be put to work *for you.* No. 271





• PRECISION LANDIS GRINDERS •

LANDIS TOOL COMPANY
WAYNESBORO, PENNSYLVANIA

TOOL ENGINEER'S PLACE

(Continued from Page 16)

in mind during the design of a tool is the factor of safety.

Tool Engineers who have specialized in some line of manufacturing such as sheet metal products and stampings or screw machine products should familiarize themselves with the latest developments in machines and tooling by carefully reading mechanical magazines and other periodicals. At the Endicott plant of IBM, we have a four-year course of study in manufacturing analysis. This course has proven to be particularly helpful to process Tool Engineers and tool designers.

Mr. Watson, our President, through his policies of education, engineering, manufacturing and selling, has inspired us to try to do a better job. Mr. Watson has said, "To make a business grow, begin by growing men. As men succeed in growing and acquire more knowledge, so do the companies for whom these men work." That is why we are doing so much at Endicott to encourage and advise our employees to prepare themselves for advancement to better positions. Much has been accomplished by the standard practice and interchangeable parts in tool designing. With this employees education, new machines, new processes and new alloys have made possible the production of far better goods at lower prices. The tools produced for parts to specifications need not always be the most costly.

Tool Engineer—a Leader

It is conceded that the Tool Engineer represents leadership in the industrial scheme of the nation. The Tool Engineer is not a casual observer. He has been trained to value details and is committed to progress. The field of Tool Engineering is so broad that one man could not successfully cover all of its important functions. Knowing this, many men have specialized in certain fields such as process engineering on milling, drilling, screw machines, power presses, grinding, gearing, etc. This type of engineering brings the engineer in close contact with the foreman of various machining departments and these contacts bring about many very interesting and beneficial discussions if the proper cooperation is used.

By this method of specialized engineering, changes are often made in methods or tools which will greatly improve manufacturing conditions because the engineer spends much of his time actually observing in the department in which he specializes. In specializing on milling, an engineer should know the various speeds and feeds by which milling should be done and he should be familiar with cutters, tooth rake and clearance and should have a thorough knowledge of milling applications in general. The grinding specialist should understand grinding wheels and grades, grits and bonds, and should know the proper wheels to use for various types of materials.

A new field which is rapidly coming to the front is broaching and there is a decided need in manufacturing today for engineers who have specialized in this method of metal removing. I do not believe that any of us feel that broaching can entirely eliminate milling but we do know that many parts which have been milled are now being successfully broached much quicker and with more uniform accuracy than they were milled.

In IBM, we have found the need for process Tool Engineers in our assembly departments on such jobs as unit assembly, sub-assembly and coil winding and a considerable amount of time and money has been saved by process engineering along these lines.

I believe the field for Tool Engineering is very essential in industry, and that trained men along these lines will be in greater demand by progressive organizations. If we feel that we do not need tool engineering in industry, let's see what would happen without it—increased costs or less profits, single track minds for manufacturing methods, selling prices could not be compiled before marketing because estimating goes hand in hand with Tool Engineering so regardless of the expense of Tool Engineers or Tool Engineering, industry could not operate without them.

Goodrich Executive Forecasts Further Gains in Southern Industrial Growth

With Southern banking facilities tripled, manufacturers doubled and installed horsepower quadrupled in the past three decades, the South stands on the threshold of a period of industrial expansion in which distributors of new plant equipment will play a leading part, Chester F. Conner, mechanical sales promotion manager of the B. F. Goodrich Company, of Akron, Ohio, told the Southern Supply & Machinery Distributors Association here today.

Speaking as a representative of the Rubber Manufacturers Association, Mr. Conner urged Southern distributors to "practice the principles outlined fifty years ago by Henry W. Grady and advise Southern manufacturers to reinvest profits in plant expansion programs to keep pace with the South's accelerating economic growth." Leading economists predict, he declared, that the South within the next decade will enter a new era of industrialization.

That this new economic period in the South is already well under way is evidenced, Mr. Conner said, by surveys of recent Southern industrial statistics. Within the past few years, he pointed out, Southern manufacturers have risen from one-seventh to one-fourth of the national total. Reports on new building in the South last year alone, he declared, reveal that the region used 31,000,000 barrels of cement, 28 per cent of the nation's total consumption. On the basis of recent surveys, the South now has two and a half times as many cotton spindles as the North and West, Conner said, while the section now produces one-fourth of the nation's furniture.

"The rapid economic growth of the South is graphically illustrated," Mr. Conner said, "by the increase in the value of its property assets from $600 for every man, woman and child in 1910 to $1,300 in 1938, a rise of 110 per cent in the South as compared with a per capita increase of only 43 per cent in other sections during the same period."

Pointing to the recently announced plans of two major chemical companies to establish Southern plants for converting wood fibres into women's hosiery, Mr. Conner said industrialists now agree that the field of synthetics already offers an opportunity for study with a view to expansion.

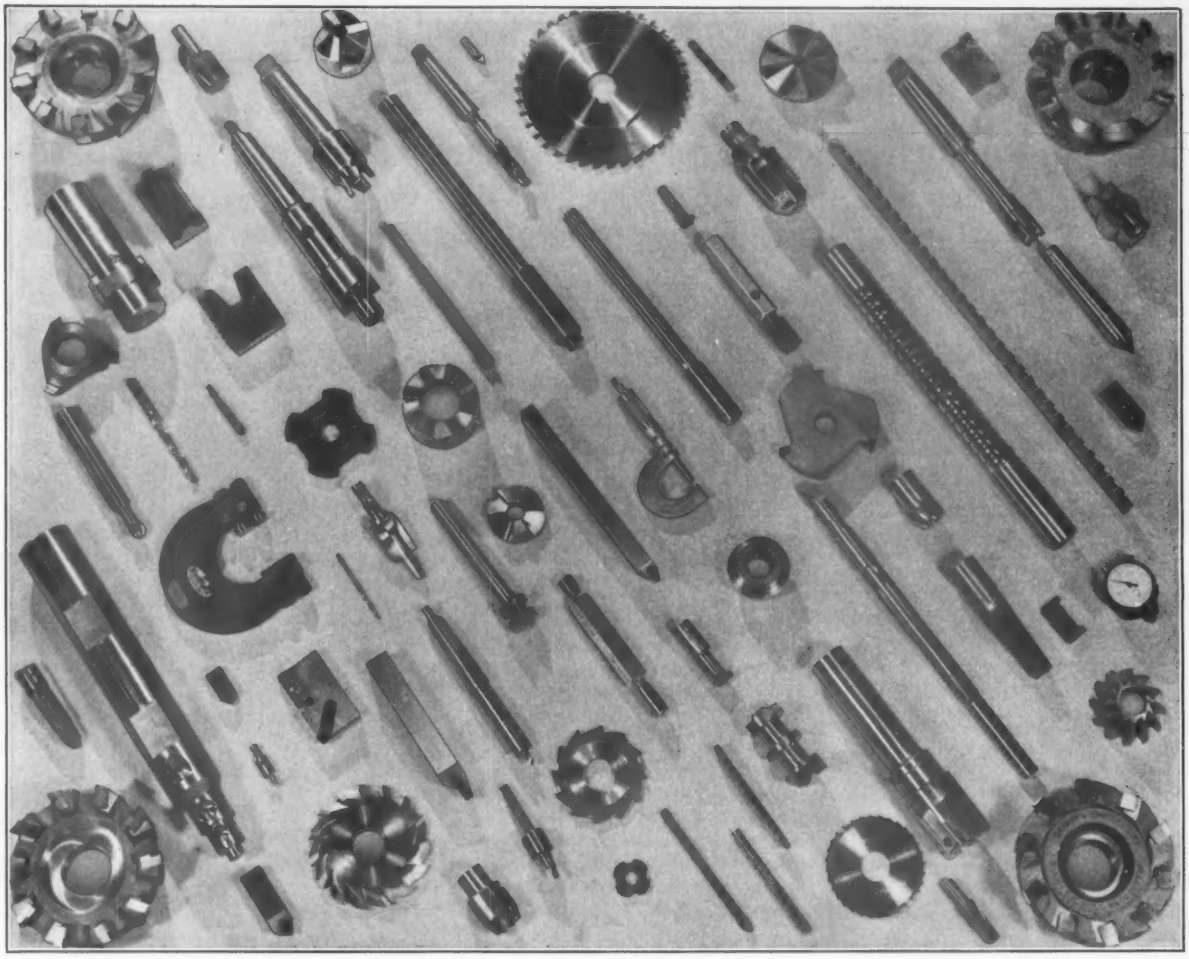
Mr. Conner told the distributors that recent developments also indicate further expansion of the lumber, pulp, paper, cement, and other process industries throughout the South.

"The rubber industry, which years ago established large textile and raw materials plants throughout the South, has contributed to development of the section's manufacturing potentialities," Mr. Conner stated.

General Motors Announces "Income Security Plan"

General Motors Corp. on Nov. 15 announced an "income security plan" guaranteeing a weekly year-around income to 150,000 hourly wage workers. Alfred P. Sloan Jr., General Motors board chairman, announced that the plan would become effective Jan. 1 for all hourly wage employees who have worked for the corporation two years or more. The plan was devised to provide for employees during slack production periods when operating schedules make it impossible to keep a full force at work. Mr. Sloan said the program would be divided into two parts to be known as the General Motors Income Security Plan and the General Motors Lay-Off Benefit Plan. It provides that an employee when laid off can borrow a percentage of his salary from the corporation to be paid back when he returns to work. General Motors officials, however, stressed the fact that the plan is not an annual wage program. "The income security plan is applicable to all hourly wage employees having five or more years' service who are in the employ of the corporation any time during December, 1938," Mr. Sloan said. "Every eligible employee is assured that in each week during the year in which the plan is in operation his income will not be less than 60 per cent of his standard weekly earnings. The standard week is 40 hours with time and a half for overtime. The plan is conditioned upon the continuation of that standard. Standard weekly earnings are defined as the pay for 40 hours at the latest average hourly rate earned. Thus, every employee eligible under the plan is enabled to make his personal arrangements for a full year ahead with assurance that in no week will his income be less than 60 per cent of his standard weekly earnings. The weekly guaranteed income will consist of (a) pay for the amount of work performed by the corporation; (b) pay for any other regular employment; (c) unemployment compensation; (d) an advance to be made by the corporation to insure a minimum weekly income of at least 60 per cent of standard. The advance by the corporation is made on the request of the employee and is payable only in terms of opportunity to work. An advance is not a liability in the ordinary sense and bears no interest. When the weekly earnings exceed 60 per cent of standard, the employee will repay advances at the rate of one-half the amount by which such earnings exceed 60 per cent of standard. Should any employee die, his unpaid advances will be cancelled."

Under provisions of the plan, therefore, an employee who normally earns $40 a week may receive an advance of $24 a week during the period he is not working. When he returns to his job he repays the loan at the rate of $8 weekly. Mr. Sloan said that once the plan is declared operative for any particular business year it is independent of changing business conditions. The second plan, known as the lay-off benefit plan, will be available to employees who have worked for the corporation less than five but more than two years. It will operate in the same manner as the income security plan except that eligible employees will be entitled to receive 40 per cent advances on their standard earnings and that the total advance made by the corporation is limited to an amount equivalent to 72 hours' earnings at the employee's latest average hourly earned rate. About 75 per cent of the corporation's present number of hourly wage employees will be eligible to benefit under provisions of the program. Mr. Sloan said that consideration was being given to a suitable plan applicable to approximately 37,000 salaried employees and that the results of the investigation would be announced shortly.



What Types of Tools Can Be Tipped With Carboloy Cemented Carbide

PRACTICALLY all types of solid and adjustable tools, cutters and gages in common use today, can be profitably tipped with Carboloy cemented carbide. Typical examples of those now being used are illustrated above. These include form and grooving tools, spotfacers, counterbores, milling cutters, reamers, boring tools, end mills, hollow mills, saws, spinning tools, twist drills, precision boring tools, gun drills, masonry drills, snap gages, dial gages, "sizematics", ring gages, micrometers, thread gages, plug gages, wire straightening dies, and numerous others.

When you think of Carboloy, think of it not just as a material with limited applications on a few difficult jobs. The use of Carboloy for cutting and wear resistant purposes can increase your profit margin on practically *all* types of common applications.

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CARBOLOY COMPANY, Inc.
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Furnish data on these types of tools:

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New Hydraulic Flow Control Valve Minimizes Effect of Pressure and Temperature Changes

By

L. R. TWYMAN

Vickers, Inc.

THE apparently impossible is sometimes accomplished. Instinctively, one expects an increasing rate of oil flow through a metering valve as the pressure upon it is increased. With the advent of hydraulic systems on machine tools this basic situation was a thorn in the side of progress for a considerable length of time, as it proved to be very troublesome to have changes in feed rates resulting from changes in system pressure. For instance, if a drill breaks through the work there is a sudden pressure change in the hydraulic feed system, and if the metered flow

Fig. 1.—Vickers Compensated Flow Control Valve for Hydraulic (oil) Control Circuits.

rate at the feed control valve should likewise vary, the drill can suddenly lunge ahead with detrimental results to both the tool and the work.

To meet this situation it was necessary to find some means whereby oil could be metered through a valve which automatically compensated for sudden pressure changes. The original design of the Vickers Pressure Compensated Flow Control Valve accomplished this result nicely. Fig. 2 indicates the practically negligible change in the flow rate during a variation of pressure from zero to 1000 lbs. per sq. inch. By way of comparison, the curve for a standard commercial design of needle valve is given on the same graph. This laboratory data, taken with both valves operating under identical conditions, show the great advantages of the Vickers Flow Control Valve, even in its original design.

Inasmuch as variations in temperature will also occur in the hydraulic control circuits used on various types of machine tools, and other similar applications, considerable research work has been done by Vickers Inc. to find a way of compensating for this second variable factor. Recently announced is a new design of the Vickers Hydrostatic Flow Control Valve, which is now available. A comparison of its operation with the operation of the original Vickers Flow Control Valve is indicated by the two curves in Fig. 3. The new valve, which of course compensates for varying pressures in a similar way as did its predecessor, shows another great improvement in that it minimizes variations due to temperature and resulting oil viscosity changes.

A third interesting feature of these flow control units is the fact that they are capable of metering very small

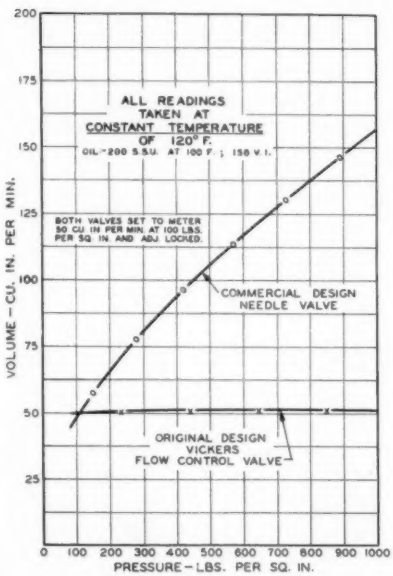

Fig. 2.—Curve showing the practically constant metering rate provided by Vickers Flow Control Valve during variations in operating pressure.

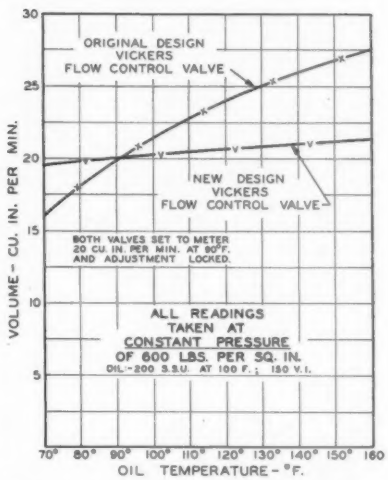

Fig. 3.—Curves showing temperature correction with new design Vickers Flow Control Valve as compared with original design. Pressure compensation features of original type are retained.

quantities of oil, many sizes being capable of handling so little as five cubic inches per minute with accuracy. At one time this was considered to be impractical, because of the fact that minute inclusions in the hydraulic system oil caused partial or complete clogging of the extremely small openings required.

The Vickers Flow Control Valve is available in a number of various sizes and each size can, in turn, be supplied with a number of different ranges of flow rate adjustment. The most accurate possible adjustment for a given application can therefore be provided.

One construction feature of note is the fact that a locking device is provided by which the flow rate adjustment dial can be locked at any desired setting, thereby making it impossible to change the feed rate without the use of a tool.

The same principles of operation as used on the Vickers Flow Control Valve are also incorporated in various other hydraulic control units of Vickers manufacture. Notable among these is the "Traverse and Feed" Panel Units which combine several hydraulic controls into a single assembly.

Detailed installation data is available from Vickers Incorporated, 1416 Oakman Boulevard, Detroit, Michigan.

New Type — BANTAM QUILL BEARING!

Excels WHERE LOADS ARE HEAVIEST

WHERE RELIABILITY IS PARAMOUNT

WHERE LOWER COSTS ARE ESSENTIAL

WIDE RANGE OF SIZES CARRIED IN STOCK!

A complete range of sizes for shafts from ½" to 5" diameter is carried in stock ready for immediate shipment. Available with or without inner races.

HERE'S the answer to your need for a bearing which takes less space, has high load capacity, yet sells at a low price. Bantam Standard Series Quill Bearings are the result of years of pioneering in the production of Quill and Needle Bearings and offer many advantages. Design has been greatly simplified. No fragile parts, thereby avoiding possibility of failure. End Thrust is taken on ribs of the one-piece channel-shaped outer race.

Bantam Standard Quill Bearings are available for immediate delivery in shaft sizes from ½" to 5".

Full Engineering Data on Bantam Standard Series Quill Bearing is available. Send today for Bulletin 103S.

For Needle Bearings to be used in lighter service request Circular 19A from our affiliate, The Torrington Company, Torrington, Conn.

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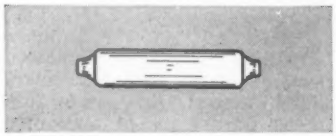
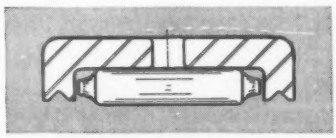
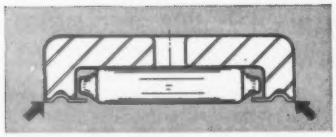
BANTAM BEARINGS



Correctly proportioned rollers with husky curvilinear trunnions eliminating high stresses on trunnions. Accurately hardened and ground for long life.



One-piece channel-shaped outer race. Rigid surfaces all accurately hardened and ground providing solid abutment for end of roller. Assures longer bearing life.



All fragile parts have been eliminated. Simplified method for definite roller retainment. Function of the retaining band is completed when bearing is assembled.

TAPERED ROLLER • • • STRAIGHT ROLLER • • • BALL BEARINGS

Handy Andy's . . WORKSHOP . .

First, an open letter to Roy Bramson, Ford Lamb, my boss—anybody: I don't resent criticism nor get mad when someone says that they can't read my handwriting. Can't read it myself after it gets cold, and don't want to any more than necessary, seeing too much of it as it is. About the only people having any luck with my chirography are my wife (who's had lots of practice), Johnny Boe (who is naturally polite), and an erstwhile school teacher who once complimented me on my fine hand. And if you don't believe that I'll show you a composition from 'way back in grade school. Only, I wasn't in a hurry, them days.

▼ ▼ ▼

Shortly before I got married, I was engaged by an internationally renowned editor (who had stepped out of role to head a machinery corporation), to iron the bugs out of a machine that, despite all claims by the promoters, just didn't tick. And because he didn't know my game, but put an intricate engineering problem in the same class as revising an editorial, he fired me—via letter. However, I couldn't read his writing, nor could anyone else, so I stayed on the job, stared out of the window (that was what got his goat), instead of making frantic haste and a paper showing, and finally got the job licked. The machine worked, and in time they made me chief engineer of the outfit. Where ignorance is bliss!—at that, I learned more of my editor-boss's game than he did of mine.

▼ ▼ ▼

With Geo. Keller, Dave Forsman and Jay Bowen taking a load off my shoulders, the Workshop can get down to meatier stuff than has been possible before. And understand, what I say here are my personal opinions; like everyone who thinks, I am groping my way to an answer of the problems that beset not only industry as a whole but engineers in particular. Now, we have seen what can be done through organization; according to its purpose, it becomes a force for creativeness and construction or its antithesis. Obviously, our ethical engineering societies—as the A.S.T.E. among others—are forces for construction, potentially, are the strongest organizations of all because they combine, in their memberships, a high degree of intelligence with a lively spirit of progress. On that assumption it is safe to say that engineers can largely shape conditions rather than that they permit themselves to be shaped by conditions.

▼ ▼ ▼

That premise does not imply a militant campaign to force our aims, but education. And frankly, we are as much in need of education as any; the more lettered the man, the more keenly he is aware of his ignorance. And as Will Rogers said: "We're all dumb in some things." As a class we are too specialized, and taking our relaxation in lighter vein, fail to get the enjoyment and benefits of a liberal education. I say, as a class; many engineers provoke plenty of thought in fields outside of their own sphere, and right in our own young Society I daresay that there is enough authoritative knowledge on various matters to fill a modest library. We have, in composite, the analytical minds, an insistence on facts with an open mind to theory that is typical of engineers, besides ability to write down our findings. All that should carry considerable weight if we decided to assume the role of educators. And assume it we must, sooner or later, the while that we further our own education.

▼ ▼ ▼

Now, we may say: "We are organized merely to promulgate the science of Tool Engineering, incidentally, to foster harmony and good fellowship." Sure!—agreed. And we're making a pretty good job of it, everything considered. But, we also have to make a living at our vocation, not so much for the salaried man who has "arrived" or whose course is fairly charted, as for the younger men, the comers. And all the fol-de-rol about youth being

(Continued on page 40)

PRODUCTION PERSPECTIVES

(Continued from page 18)

of a production layout, to $285,000 for new and improved equipment.

The majority of the manufacturers reporting stated they would go ahead with the programs and would continue to spend the greater portion of their depreciation reserves for plant and equipment improvement, replacements and additions. **With brighter business conditions prevailing, it is expected that other New England manufacturers will either start new modernization programs or will resume long-postponed programs.**

A definite upward trend in employment **in** the metal trades and a prediction that business in **Springfield's largest plant, the Westinghouse factory, will take a turn for the better, are combining to cast a spirit of optimism over the entire business outlook in Western Massachusetts. Total employment on Nov. 1 in 25 metal working firms showed an increase of 655 workers, according to** Secretary **A. R. Tulloch,** of the Western Massachusetts branch of the National Metal Trades Association. **L. E. Osborne, works manager at the Westinghouse plant, said that an uptrend in business should be felt in December.** He said that during the last month some gain has been noticed and that it has been **reflected in increased work hours for the 2,050 employes** now on the plant pay roll.

Removal of the Goddard Works of the Wickwire Spencer Steel Co. in Worcester, Mass., to a new plant under construction in **Buffalo, N.Y., will begin "early next Spring," according to Paul M. Macklin,** general manager of the company. The Morgan Spring Works of the company in Greendale will not be affected, under present plans. Company officials explained that competition has made it essential for the company to move its wire works nearer the mid-Western markets where the bulk of the company's products is sold.

Production of the Garand semi-automatic rifle at the Springfield Armory, now at the rate of **10,000 a year** and giving **employment to more than 1,500 men, will probably be doubled during the next fiscal year, Maj. Gen. C. M. Wesson,** chief of ordnance of the War Department **announces.**

Nearly 2,000 employes of the Wickwire Spencer Steel Corporation at Palmer and Worcester, Mass., and Trenton, N.J., **benefited by a 12½ per cent pay increase.**

Carl J. Leafe, who has been identified **with the Norton Company, Worcester, for about 30 years,** has been **made superintendent of the Norton Company of Canada,** Limited, at Hamilton, Ont., **to succeed Albert Johnson, who has been appointed consulting engineer** of the **Canadian plant. Employment and production hours are increasing in Worcester.** The pickup has been under way about two months. **The machine tool industry is benefiting from the higher operating schedules in the automobile business and from the distinct changes in 1939 models which necessitate some retooling.** Both large and small machine tool plants are reacting to this business. At the **American Steel & Wire Co., Worcester, production** has **climbed to about 60 per cent of capacity,** according to Carl I. Collins, district manager, as compared with a low point of 30 per cent in the summer. The **Greenfield Tap & Die Corp.** of Greenfield, Mass., has been **awarded a government contract for inspection gages, totaling $34,123.30.** The **Chapman Valve** Co., Indian Orchard, **has received a government contract for $336.21 for steel valves.**

Dresser T. Bates of Orange **observed his 96th birthday, Nov. 19. For many years Bates was employed as foreman in the toolroom of the New Home Sewing Machine Company and during this period made nearly all the machinery which was installed in the needle department. Some of this was of his own invention. Later with** the late **Frank S. Ewing and Stephen French, he organized the Athol Machine Company which was operated by the trio until it was sold to the late L. S. Starrett.** Bates continued his association with the organization after its sale. He served as superintendent of the factory until his retirement 18 years ago.

A 15 per cent pay cut has been restored to office employes of the Simonds Saw & Steel Co., Fitchburg, Mass. Other offices of the concern in this country are reported affected, including offices in Lockport (N.Y.), San

(Continued on page 36)

Mr. Jay Bowen, Die Editor,
The Tool Engineer:

Much has been said and written on necessary qualifications to hold a foreman's or other supervisor's position. Books, magazines, lectures and executive meetings have done wonders.

Conditions have and are changing continuously, due to the labor system and other classifications well known to all who come in contact with the human element in the industry of today.

The acute labor situation in all industries will result in a different leadership to maintain production. This applies especially to Tool Rooms where first class mechanics are employed. Many tools and fixtures are often costly and not within the estimate, because the order was given to do the job a certain way.

Therefore, it is appropriate at this time to suggest for the rank and file of supervisors, the vital points necessary to bring satisfaction and clear understanding. A supervisor knowing his field of endeavor thoroughly can still be a failure, if he lacks understanding of direction and coordination of the human element in the organization. A supervisor must be a specialist nowaday in the handling of men to get the best work from them. If he deals with men as he expects others to deal with him, he will be the winner.

A wise supervisor knowing the ability of his men thoroughly will discuss the job to be done with his men, giving the cost or estimate, and allowing them to express their method of doing the job. This will create confidence and cooperation, which will result in the job being done without loss and within the required time.

Being the middle man between the management and labor, the supervisor is responsible for knowledge of principles, theoretical and practical. The principles coming within direct relationship to the work come under measurements, planning, budgeting, scheduling and knowledge of supply and operations. Working force, working skill, attitude, service, welfare and safety come under direct relationship to the working man.

The supervisor using such diplomacy and knowing the managing principles will be well liked and will get the best out of his men. They will give their best effort and initiative at all times, and under any conditions.

John J. Pommer,
Foreman, Die Dept. Westinghouse Electric & Manufacturing

▼ ▼ ▼

Bramson Publishing Co.
2842 West Grand Blvd.
Detroit, Michigan.
Dear Sir:

I enclose $1.00 for which please mail me a copy of "Tool Engineer."

Paul Ash.
Milwaukee, Wisconsin.

Mr. Ash—you are either a very ardent student of Tool Engineering or you must be a diligent practitioner of your profession. Which is it? "The Tool Engineer" is not sold and we have gladly sent you a copy of a late issue, and under separate cover your dollar. Thank you for the compliment.—Editor.

PRODUCTION PERSPECTIVES

(Continued from page 34)

Francisco, Portland (Ore.), Seattle, (Washington), New York City and Chicago.

October brought further evidence of recovery in Connecticut's industrial "barometer" city, Bridgeport, when the average weekly payroll for plants reporting to the Chamber of Commerce **climbed nearly 10 per cent over September to $976,082. This contrasts with $1,207,964 in October, 1937,** a loss of 19 per cent, **but is a highly favorable showing when it is considered that for many months the payroll figure has been running 25 per cent or more behind that of the corresponding month last year. The week ending October 8 showed the employment total at its highest level since last February, and man-hours the highest since December 11, 1937,** according to the Bridgeport Manufacturers' Association. **From elsewhere in the state, too, come encouraging reports, with executives** of Scovill Mfg. Co., American Brass Co., Chase Brass & Copper Co. and Lux Clock Co., all in Waterbury, **express-**

ing optimism as to the winter outlook. Russell Mfg. Co., Middletown, **announced November 10 that salaries and wages cut early this year will be restored to original levels beginning with the first pay period in December. The order will affect about 1,000 employees. Nearly 400 have been called back to work in recent weeks.** DuParquet, Inc., has bought buildings and land at 232 Main street, Norwalk, and will engage in the manufacture of kitchen equipment for hotels and restaurants, planning to employ 100. . . . Lewis Beers Curtis, 75, president of Curtis & Curtis, manufacturers of pipe threading and cutting machines, Bridgeport, died October 25. Bridgeport Brass Co., Bridgeport, has started reconstruction and modernization of its Housatonic avenue tube mill at a cost expected to reach $50,000.

DEVELOPMENT OF H. S. S.

(Continued from page 26)

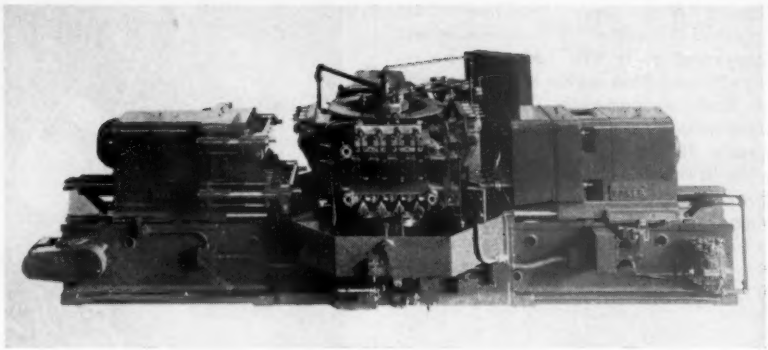
in a position to specify not just that a tool be made of high speed steel, as is common practice at present, but, by means of a symbol for the steel specification, would assure the use of a definite analysis and heat treatment. This would give the lowest possible tool cost and best results on machining the many parts that go to make up a completed product.

NEW *Equipment*

Baker No. 3½—16 Three Way Unit Type Way Driller and Tapper

A new machine for low cost manufacture with modern improvements in design to reduce fatigue to operator and give increased life to machine with a minimum down time for maintenance. Units flexible for change over, with all vital operating mechanisms accessible.

Work Handled—Steering knuckle support arms each with two tapped holes at 17" centers. One end of arm support having a special thread hole. Diameter .752; other end special thread hole, diameter 1.140". Material drop forgings, approximately .50 carbon.



Baker 3-Way Driller

Operations Handled—From left unit lower 4 spindles drill 1-5/64" dia. Upper 4 spindles drill ⅝" dia. From rear unit lower 4 spindles ream 1.102" dia. and chamfer. Upper 4 spindles ream .657" dia. and chamfer. From right unit lower 4 spindles tap 1.14" dia. 11 threads per inch. Upper 4 spindles tap .752" dia. 11 threads per inch.

Arrangement of Machine—Machine with center bed of heavy well ribbed construction, material steel. Bed carrying ample size chip and lubricant pan. On center of bed is mounted a heavy upright fixed casting carrying upper and lower large size ball bearings for mounting of the 4 station turret. The indexing turret is 4 sided approximately 32" across fixture mounting surfaces. Turret arranged with automatic index with vertical mounted index plunger for approximate location of turret. Each fixture with 4 pilot bar bushings for securing final location of turret from heads, from pilot bars mounted to sides of heads. 3 units are mounted to center bed: One to the left at 90 degs. from the chucking position; one to rear, and one to right. Each standard unit of new design with bar mounted saddles, each carrying 8 spindles heavy duty fixed center head. Units operated in unison and are automatic in cycle with electrical interlocked control. The controlling is arranged with full safety features so that turret cannot index until heads are fully back in a clear position, nor can heads advance while turret is indexing. Automatic index of turret is of simplified design, new in principle with index drive mechanism all contained in vertical housing mounted between right and rear units to rear right of machine.

Units—New design No. 3½—16 standard units with saddles mounted on four 3½" dia. alloy steel bars, insuring a minimum of wear with a resultant continued accuracy of alignment of units to turret and work holding fixtures. The units are furnished with saddles 24" x 40", each saddle with four bushings 4¾" long with provision for automatic lubrication. The saddles are mounted on four bars which bars mount in end brackets bolted to the steel unit bed. The use of four bars reduces the length of bars between bar supports. The bars used are 24" in length between the bar supports. With the materials specified for the bars and bushings the wear factor is 1/85th of a design using case hardened to case hardened. The total bearing area of the four saddle bushings on the bars is 66.48 sq. in. With the above wear factor you can appreciate that with hardened flat

(Continued on page 41)

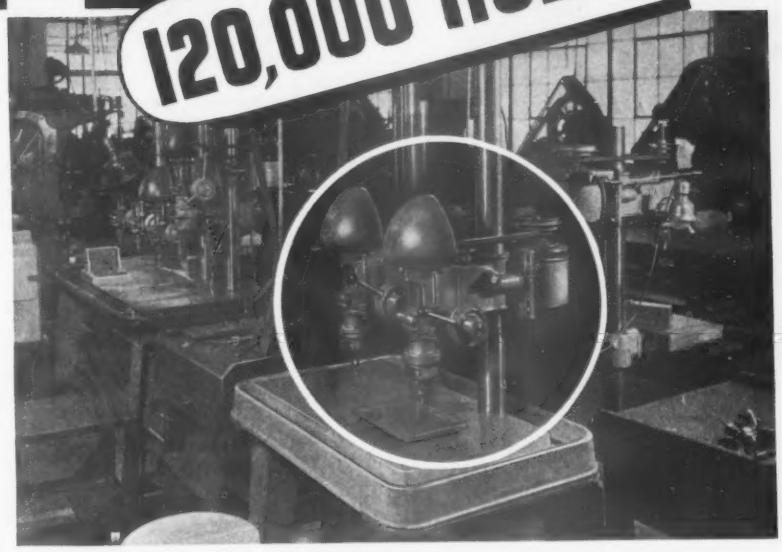
TAPPED 120,000 HOLES

With Only Three Broken Taps

That is the record made with Delta drill presses and tapping equipment with 3-48 and 6-32 taps—in steel—at the Hedman Mfg. Company, makers of the famous F & E Check Protectors. And in this same plant Delta Drill Presses drill 30,000 holes a day, day after day, throughout the year.

Do you know the story of Delta low-cost drill presses—how they are cutting costs for thousands of alert manufacturers?

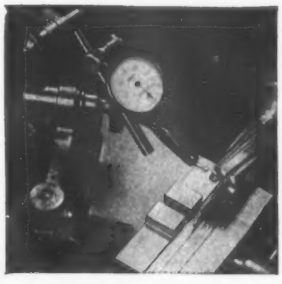
Consider these advantages of the Delta Drill Press—Low first cost, economical operation, low maintenance cost, portability, flexibility, compactness, and prompt delivery—and see if you cannot cut your production costs by adopting these efficient light power tools. Write today for the full story of other installations, specifications and prices on the complete line of Delta Drill Presses.



DELTA MANUFACTURING COMPANY
618 E. Vienna Avenue, MILWAUKEE, WISCONSIN

Adjustable holding bar and clamp. Dial can be set any position.

UNIVERSAL TEST INDICATORS
Very useful for general checking. Graduated in English .001" and .0001" or in metric .005 MM and .01 MM.



Universal Test Indicator in use with surface gauge on milling machine.

Point, set any position and motion reversible.

One of 60 different models of Dial Indicators having graduations from .000025" to .005" and various ranges and sizes. Full jeweled bearings. Accurate, dependable and durable.

Bench type of plug gauge. One of many types of dial gauges. Cylinder, thickness, depth, etc.

PRECISION MEASURING INSTRUMENTS

Check your machine parts for accurate sizes. Modern production requires careful inspection of specified dimensions. That is why FEDERAL Dial Indicators and Gauges are being used more than ever before. The majority of indicators used by United States manufacturers are FEDERALS. They are extremely accurate and serviceable and are made in many styles for many purposes.

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1144 Eddy St., Providence, R.I., U.S.A.

Accuracy Plus Versatility

THE MAUSER VERNIER CALIPER—

A Handy Pocket Tool For Every Tool Engineer

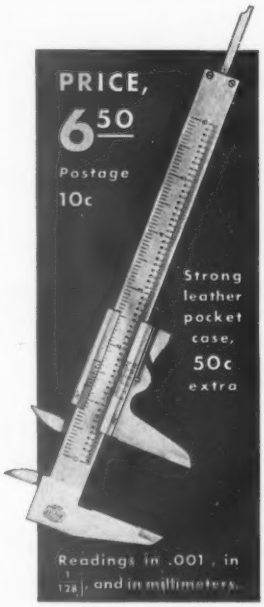
Here is a precision tool that may be used for measuring in 1/1000", 1/128" and millimeters up to 5-5/16" for outside, inside, root and depth dimensions.

May be used in shop and office, in tool room and on drafting board. A universal tool with guaranteed accuracy.

THREE GRADUATIONS
1. Front Scale, Top: 1/16" to read 1/128" on vernier.
2. Front Scale, Bottom: 1/25" to read 1/1000" on vernier.
3. Back Scale: Centimeters and millimeters to read 1/10 mm. on vernier.

OTHER FEATURES
Bevelled Jaws for Root Measurements, Cross Horns for Inside, Easy to Read, Fine Tool Steel, Depth Gage.

SPECIAL OFFER TO TOOL ENGINEERS
This tool will be sent on a 10 days' trial basis to readers of "The Tool Engineer." Send your order in today. If tool is not all we say it is, if you find you cannot use it, you may return it for **full refund.**



George Scherr Co., 132 Lafayette St., New York

HANDY ANDY'S WORKSHOP

(Continued from page 32)

served to the contrary, the cold fact remains that the leaders in the game are mainly middle aged; for us, "life begins at forty." True, the older among us knew years of preparation, we stepped from bench to foremanship, from draftsman to designer, on up, but for us there were also wider opportunities, we were largely masters of our own destinies. Ambitious, we studied and prepared, were ready, and if we didn't always get the breaks we still stuck to a principle. After all, the nearer you get to the top, the less room there is.

▼ ▼ ▼

You know, we were largely instrumental in evolving this Machine Age, having inherited from our immediate forerunners the embryonic creations that, in a generation, have all but revolutionized civilization. Modern youth conceives with difficulty a world without automobiles or airplanes; we gawked at the first "horseless carriage" or "aeroplane," perhaps hied to build our own. Or we made tools and machinery for their production, tried to anticipate—at least keep pace with—the ceaseless trend of change. Well, there's our baby, still squawking from growing pains, but lusty now and getting a bit hard to control, even shows signs of wanting to take control. Having conceived and delivered, so to say, what are we going to do about it?—are we going to educate the baby into ways of righteousness or shall we go modern and be palsy-walsy, at risk of degenerating our own moral fibre? For me, I say be the masters, only, let us go about it judiciously and with patience. Finesse, you know.

▼ ▼ ▼

One of the first things to dispel is the myth that automatic equipment and tools create unemployment. I have been chasing this canard for years, find that all evidence points to the contrary. We have, however, the paradoxical situation that we design tools to displace labor and to reduce production costs, yet, the more tools, the more goods and the more buyers—and more work. With, it might be added, a shorter work-day, more leisure for the workers. But (sotto voce) will they use it to advantage? I believe so—at least, that minority that is the nucleus of progress will use its leisure wisely. Look at our technical schools!

▼ ▼ ▼

Now that Pres. Wagner has appointed a Fact-Finding Committee, presumably to support opinion with indisputable fact, we may be able to authoritatively establish the place of the automatic machine in industry. And if my insistent contention—that it creates employment—is not sustained I'll be the most surprised man in the U.S.A. But if supported, then we spread the findings; we'll want the world to know.

Yours for Progress,

HANDY ANDY.

(Continued from page 38)

ways and hardened inserts on saddle to secure the same wear factor, a saddle bearing on ways of 5650 sq. in. would be required.

Eight Spindle Fixed Center Heads—The multiple heads required are mounted to head brackets, which brackets are mounted to unit saddles. The multiple heads are direct driven from motors mounted on motor bases in head brackets. Each multiple head has provision for pick-off gears for changing of speed of spindles. All spindles are mounted on ball bearings with in and out adjustment sleeves provided in spindle ends for setting of tools.

Fixtures—Four holding fixtures are furnished mounted to the four turret positions. Each fixture is arranged for chucking four parts. The two locating dowel pins are moved into each part through means of hydraulics with the movement of all locating pins controlled from one valve. The parts are hydraulically clamped and held rigidly in position. This means of locating and clamping gives a minimum of fatigue to operator as it is only necessary for the operator to remove four parts and place four new parts into position.

Tool Supporting—The cutting tools carried from the left and rear units are supported in tool support bushing plates mounted from bars carried at side of heads. Individual bushing plates are mounted for the upper row of four spindles and lower row of four spindles on each unit head. The bushing plates are carried up into position with the unit heads and the bars plugged into pilot bushings in fixtures. A lubricant system is provided for the coolant and an ample supply of lubricant is delivered to each one of the cutting stations at each one of the cutting points. A centrifugal motor driven pump with 80 gal. per min. delivery is mounted to the rear of machine.

LeBlond Deep Hole, Drilling, Boring and Reaming Lathe

A new deep hole drilling, boring, and reaming lathe has just been announced by the R. K. LeBlond Machine Tool Co., Cincinnati. The new LeBlond deep hole boring lathe was designed not only to meet the government's gun boring requirements but also to qualify for dozens of applications in the industrial field, such as, boring holes for hydraulic cylinders, oil well casings, etc.

For government requirements, the lathe will handle stock 96" long, 5¼" outside diameter, and will bore a hole a maximum diameter of 1½". For industrial use, the machine can be adjusted to take stock any length, 5¼" outside diameter, boring a hole of 2½" maximum diameter.

In addition, the LeBlond deep hole boring lathe has the following other special features:

1) **Bed:** The rigid box construction bed of high grade cast iron provides a wear-resisting, non-galling surface the entire length of the ways. The smooth finish, true contact surface ways are designed to prevent lift or twist of the carriage under maximum working conditions.
2) **Feed Mechanism and Control:** Regardless of resistance variation, the hydraulic feed mechanism provides uniform feeds from .0006" at 500 r.p.m. up to .380" at 20 r.p.m. of the spindle. Stops shut off the feed when the carriage reaches the required limits. A safety stop comes into action, when overloaded, shearing the safety pin.
3) **Headstock and Spindle:** The headstock mechanism provides three mechanical changes of speed through sliding gears. By means of change gears in the headstock and a 20-point field rheostat, the hollow spindle has a range of spindle speed from 20 to 515 r.p.m.
4) **Coolant System:** A self-contained coolant system, equipped with an electric motor driven coolant pump with a capacity of 15 gallons per minute and 500 pounds maximum pressure supplies the cutting tool with a steady, cool stream. The coolant returns to a baffled settling tank, from which it is forced through two Cuno filters by the above described pump.

Further description of this deep hole boring lathe will be sent upon request. Address the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, mentioning "The Tool Engineer."

ILLINOIS TO HAVE TWO MORE CHAPTERS OF A.S.T.E.

The Tri-Cities of Moline, Rock Island and Davenport will have their chapter of the American Society of Tool Engineers chartered on December 2nd, 1938. Peoria held a meeting November 18th at which more than 200 attended, and it was decided to charter a chapter there in the near future. This makes a total of four chapters in this state with chapters at Chicago and Rockford.

Keep Your Catalog Files Up To Date

Get Your Free Copies of These Catalogs by Using Coupon Below

1. Nice Ball Bearing Company, 30th and Nicetown Lane, Nicetown, Philadelphia, Pennsylvania, have recently issued a substantially bound sixty-four page catalog describing their line of ball bearings and giving much data, tables and diagrams on the application of these bearings.
2. "New Variable Speed Transmission" is the title of a new bulletin describing "A million speeds at your finger tips" and descriptive of the "Selecto-O-Speed" Transmission, recently announced by the Ideal Commutator Dresser Company, 1223 Park Avenue, Sycamore, Illinois.
3. A new circular which gives all the specifications and details for the "Tom Thumb" Dumore Precision Grinder for small lathe work has been issued by the Dumore Company, Racine, Wis. Points covered in the circular are: its extremely small size, adaptability to wide range of work, many uses for work other than grinding, its newness or novelty as it is claimed that the new "Tom Thumb" has never been duplicated before—especially at the low price listed.
6. R and L Tools, Nicetown, Pennsylvania, have released a new booklet illustrating and describing the complete line of R and L products.
7. Oliver Instrument Company, Adrian, Michigan, has just issued a new folder illustrating the Oliver "Arc" Face Mill Grinder. A new circular has also been issued by this company describing their new type Drill Pointing and Sharpening Tool.
8. Standard Gage Company, Poughkeepsie, N.Y., have issued a new bulletin picturing and describing their Universal Surface Gage and Comparator.
9. Sundstrand Machine Tool Company, Rockford, Illinois, have recently issued an attractive 8½ x 11 eight page bulletin "Introducing the Number O Rigidmil." The bulletin attractively illustrates and describes this new machine in the Sundstrand line, gives complete specifications and data with many drawings to illustrate the various features of this machine.
10. A new piece of literature recently issued by H. K. Porter, Inc., Everett, Mass., illustrates and describes Hand Operated Cutters as manufactured by the company.
11. Zeh & Hahnemann Company, Newark, N.J., have issued a new catalog describing and illustrating in detail the line of Z & H Presses.
12. E. F. Houghton & Company, Philadelphia, Pa.—a new four page 8½ x 11 bulletin on "Cut-Max" straight cutting oils and bases—"culminating years of cutting research by Houghton." This is an interesting bulletin describing the research conducted through a formulae tested effectiveness of this new cutting oil. Photographs of sample parts, tool bits, etc., used in the research are shown and described.
13. The Lincoln Electric Company, 12819 Coit Road, Cleveland, Ohio, announce the New Lincoln Electric Bulletin entitled "Arc Welding Electrodes & Accessories—with procedure for welding of various metals." Procedures for producing all types of welds in mild steel, for welding all metals used to any extent industrially and for applying surface metal to meet any type of wear-action in service, are given in the new bulletin—thirty-six pages, 8½ x 11.
14. Two catalogs have been issued by Gisholt Machine Company, E. Washington Avenue, Madison, Wis., which describe the Gisholt Universal Turret Lathes and High Production Turret Lathes. Particular attention is paid to how to reduce machining costs through the use of Gisholt standard tools for the Gisholt Turret Lathes.
15. An entirely new product is described in a four page bulletin recently issued by The Kravan Company, Waterbury, Conn. The bulletin "Re-Vise your Machine Tools with 'Down-Grips'" and lists these advantages: simultaneous face and down grips, no distortion of work, puts precision into speedy mass production, seconds to level instead of minutes, lowers cost of production. Many new and novel features are claimed for this 3-way pressure machine vise which it is claimed accurately grips and automatically levels while the jaws exert a downward pull.
16. Bulletin No. 7638 issued by Stephens-Adamson Mfg. Company, Aurora, Illinois, will be sent to interested parties upon request. It describes and announces a new line of "SACO Speed Reducers" which Stephens-Adamson Mfg. Company has added to their line of J.F.S. Variable Speed Reducers. The bulletin describes the SACO Speed Reducers which can be used with any standard, full speed motor to give required output speed. It describes other mechanical features as well as the applications of the new SACO Reducers, which is is claimed, are literally universal.
17. Stanley Electric Tool Division of The Stanley Works, New Britain, Conn., have issued a bulletin sheet describing the new "Victor" Drill ⅝ and ¾ inches. A photograph is shown and the special features of these new drills are described, as well as specifications, etc.
18. The Standard Electrical Tool Company, 1939 West Eighth Street, Cincinnati, Ohio, have issued a bulletin describing the 'Cadet' 12 inch Ball Bearing Pedestal Grinder which was developed to meet the demand for a low-priced tool without sacrificing substantial construction. Complete specifications and descriptions are given.
19. The Winter Bros. Co., Wrentham, Mass., have issued a new handbook on Tapping, containing valuable information for tap users.
20. R. G. Haskins Company, 2756 West Flournoy Street, Chicago, have issued a new folder describing the Haskins line of Rotary Files.
21. The Texas Company, 137 E. 42nd Street, New York, N.Y., have published a new booklet describing the lubrication of ball and roller bearings.
22. The Gammons-Holman Company, Manchester, Conn., have a new catalog describing their line of Gammons Reamers and End Mills.
23. Stock gears, sprockets, flexible couplings, speed reducers, etc., are described in a new catalog issued by the Charles Bond Company, 619 Arch Street, Philadelphia, Pa.

THE TOOL ENGINEER
2842 W. Grand Blvd.
Detroit, Mich.

Send me literature as described above, the numbers for which are as follows:

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DO IT NOW

ADVERTISERS' INDEX

LAPPED FITS ELIMINATED

Gas Cock Bodies and Plugs Now Produced On Ex-Cell-O Precision Boring Machines

The American Stove Company, of St. Louis, a year ago developed its improved "Simmer Set" gas cock. In tooling for this job, the company wished to improve its method over the former manufacturing set-up which produced tapered gas cock body and plug seats by reaming and turning, and then lapping the parts together. The company was not satisfied because this method left abrasive embedded in the seats that was detrimental to the operation of the gas cocks, and because parts were not interchangeable.

Four Ex-Cell-O Precision Boring Machines were therefore installed, for boring the bodies and turning the plugs. Proper fits are now obtained without lapping. To check fit, a thin narrow strip of prussian blue is applied the full length of the plug; when turned in a body, the plug shows almost 100% contact. The clean, smooth precision bored and turned finish insures minimum wear in operation. Selective assembly is not necessary, because any plug is a mate for any body.

Other manufacturers of tapered valve bodies and plugs are likewise reducing their production cost and improving the quality of their products with Ex-Cell-O Precision Boring Machines. We would like to send you data on several such installations, and to show you the results that can be secured in your plant.

EX-CELL-O CORPORATION, 1204 Oakman Blvd., Detroit, Mich.

Please send me, without obligation, data on precision boring and turning tapered bodies and plugs.

Name ..... Title .....

Company .....

Address .....